Tupolev Tu-22 'Blinder' Tu-22M 'Backfire'

Russia's long range supersonic bombers

Yefim Gordon and Vladimir Rigmant

AeroFax

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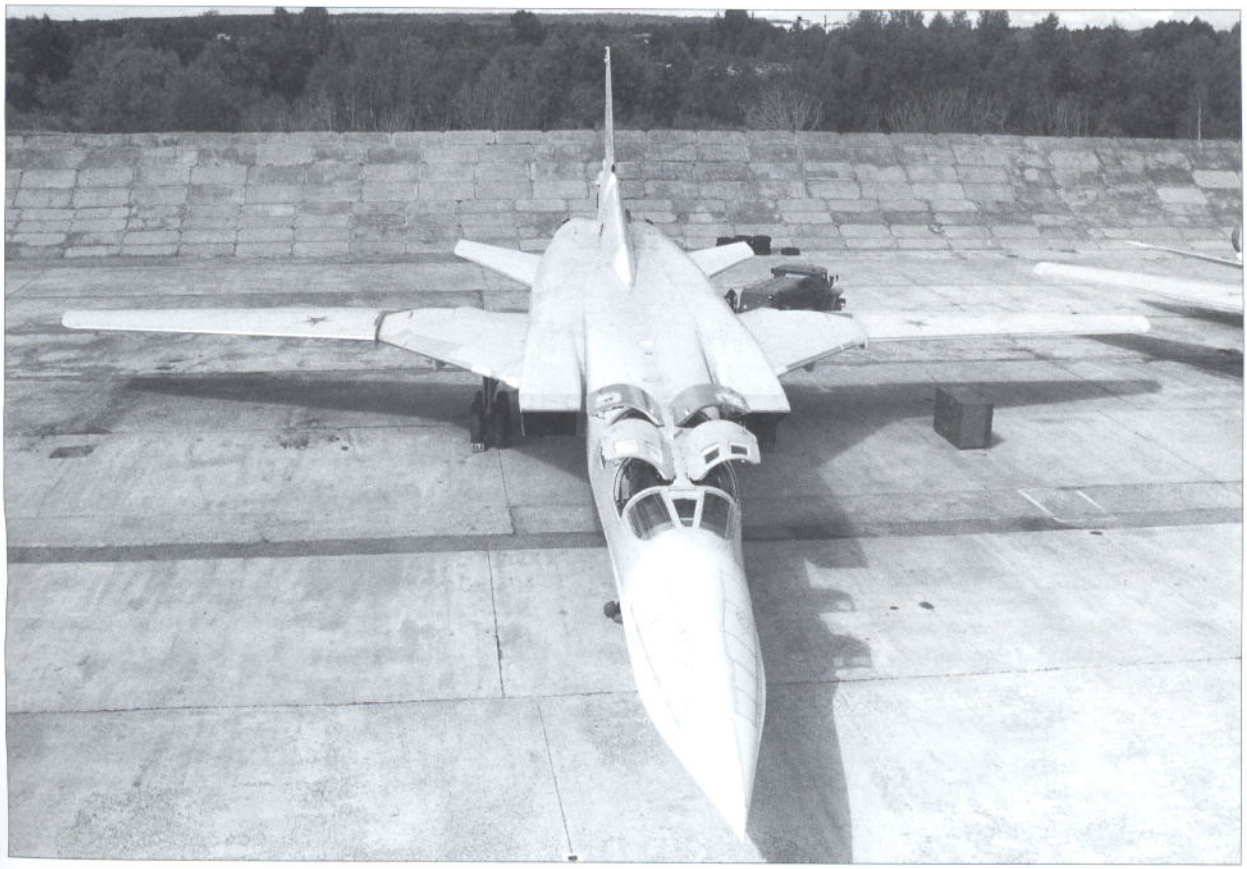

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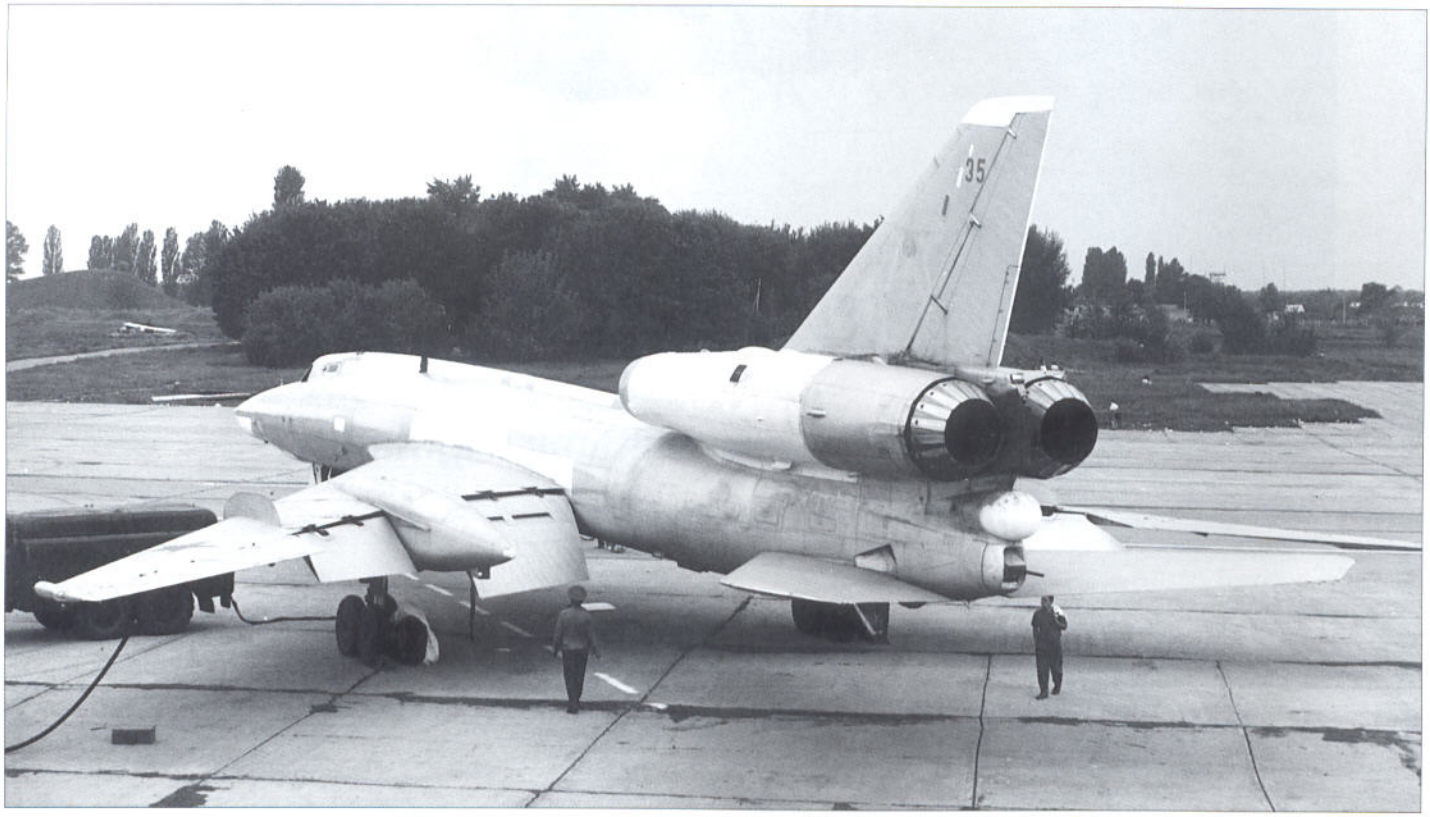
Title page photograph: **Dramatic view of a Tu-22M3 'Backfire-C' at the Ostrov Naval Aviation Centre, 1997.** Yefim Gordon

Below: **Rearward aspect of a RD-7M-2 powered Tu-22R 'Blinder-C' at the Ukrainian Poltava airbase.** Sergei Popsuyevich



Introduction

Almost 40 years ago, on a summer day in 1958, a new aircraft made its first flight at the Lyotno-Ispytahte'nyy Institoot (Flight Research Institute named after Mikhail M Gromov) near the town of Zhukovsky south of Moscow. The aircraft was a new supersonic long range bomber, the latest product of the Tupolev design bureau and known as the 'Model 105'. The flight was the beginning of the long history of what was to become known as the Tu-22 family.

By Soviet standards, a long range bomber (a medium strategic bomber in Western terms) is an aircraft capable of delivering conventional and nuclear weapons within a combat radius of 2,000 to 3,000km (1,242 to 1,864sm), ie within the European and Pacific theatres of operations. Soviet long range bombers had to be capable of hitting US military bases and major political and industrial centres of US allies. This, according to Soviet military doctrine, should stop the West from using medium range and strategic weapons against the USSR and its European allies.

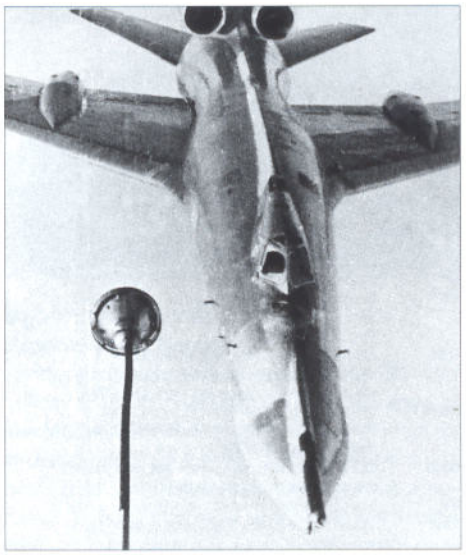
The geographical position and political status of the USSR after the Second World War led it to attach special importance to developing this class of combat aircraft. The performance of long range bombers kept steadily improving, new offensive and defensive armament and better avionics were developed.

In the late 1950s and the early 1960s, the bombers received stand-off air-to-surface missile (ASM) delivery capability. While increasing the chances of mission success, this approach called for closer co-operation between the teams designing the aircraft itself and the weapons it was to carry.

Another important role of the long range bombers was anti-shipping strikes – knocking out NATO carrier groups before they got close enough to launch their aircraft, and destroying US transoceanic shipping convoys supplying European and Pacific theatres. The latter was to disrupt NATO operations and assist the advance of Soviet forces.

This explains why the Commonwealth of Independent States (CIS) is effectively the only remaining operator of medium range bombers in the world today. In the 1950s such aircraft were the only means of delivering weapons within this radius. Starting in the late 1950s, they were augmented by medium range (or tactical) ground-launched missiles. When the latter weapons were limited by a treaty in the late 1980s, the bombers were retained as an alternative delivery vehicle.

In the West, things developed differently. The Boeing B-47 Stratojet was retired in the 1960s; the supersonic Convair B-58 Hustler did not gain widespread use and was finally retired in the early 1970s. The follow-on General Dynamics FB-111A was rather too small to be included in the medium bomber class. The British subsonic V-bombers (Vickers Valiant, Avro Vulcan and Handley Page Victor) were soon retired or converted to aerial refuelling tankers. The French Dassault Mirage IVP tactical nuclear bomber had inadequate range and was replaced ultimately by the Mirage 2000; surviving aircraft were converted to Mirage IVR standard for reconnaissance duties. Accordingly, Soviet-built medium bombers are the only ones remaining operational in their class.



A Tu-22KD aerial refuelling. Yefim Gordon archive

Soviet supersonic bomber design practice goes all the way back to the early 1950s when the design bureaux led by Andrey Nikolayevich Tupolev and Vladimir Mikhailovich Myasischchev were working on a spate of strategic bomber projects. Various configurations were studied, including delta wings, high aspect ratio wings and highly swept wings (up to 55°).

Concurrently work was under way on new afterburning turbojets rated at 98 to 196kN (22,045 to 44,091 lb st) in full afterburner and more capable avionics. The range and accuracy of air-launched cruise missiles was also constantly improving. Thus, by the mid-1950s the Soviet defence industry was ready for a new long range supersonic bomber.

The Myasischchev design bureau came up with several projects including the VM-32 and VM-34 bombers with a range of up to 6,000km (3,726sm) at transonic and supersonic speed. These were abandoned, as in 1954 the OKB switched to heavy intercontinental bombers, such as the M-50/M-52 (ASCC 'Bounder') and never came back to medium bombers.

This left Tupolev's OKB-156 as the sole Soviet designer of medium bombers (with no anti-monopoly commission to speak up against it). When the successful Tu-16 'Badger' (or Tu-88) subsonic long range bomber entered production in 1953, Tupolev embarked on a whole range of supersonic bomber projects with a take-off weight ranging from several dozen tons to several hundred tons.

Two main layouts were studied – a conventional swept wing aircraft and a 'flying wing'. The former study led to the Tu-98 'Finback' twin-engined experimental bomber which evolved into the Tu-128 'Fiddler' long range interceptor – and to the Tu-105. The Tu-108 and Tu-109 flying-wing bombers never got off the drawing board but had a considerable influence on later Tupolev projects – the Tu-125 and Tu-135 long range strike aircraft of the early 1960s (which also remained unbuilt), as well as the Tu-144 'Charger' supersonic airliner which did materialise.

The design bureau built on the experience gained with the Tu-16 in designing a supersonic bomber. Tupolev was rather conservative in his views; one of his oft-quoted expressions was 'If an aircraft is 70% new it is a guaranteed flop'. Thus, the transonic Tu-103 project – the first development step – was basically a Tu-16 with new wings swept back by 45° and four Dobrynin VD-5 or VD-7 afterburning turbojets. As on the Tu-16, the engines were placed in the wing roots but paired vertically *à la* English Electric Lightning interceptor rather than horizontally as on the de Havilland DH.106 Comet airliner or the Myasischchev M-4/3M 'Bison' bomber. However, it was soon apparent that this evolutionary approach was a dead end.

What was to emerge was the Tu-22 'Blinder', a versatile and well-respected weapons system. From it was to 'evolve' an even more formidable creation, the Tu-22M 'Backfire'. These very different aircraft have a uniquely interlinked story, here told in depth for the first time.

Yefim Gordon and Vladimir Rigmant
Moscow
June 1998

Abbreviations and Designations

A	Ahtomnyy, or nuclear(-capable) – as a designation.
AFA	Aerofotoapparaht – aerial camera.
AFCS	Automatic Flight Control System
AFU	Artificial Feel Unit.
AoA	Angle of attack, the angle between the zero lift line of the wing and the airflow. Sometimes referred to as 'alpha'
APP	Apparaht Postanovki Pomekh – jamming device, eg chaff.
ARM	Anti-Radiation Missile.
ASCC	Air Standards Co-ordination Committee, (of NATO) allocated reporting names to WarPac types, eg 'Blinder'.
AV-MF	Aviatsiya Voyenno-Morskovo Flota – Naval Air Arm.
B	Bombardeerovschchik – bomber (for the export models); as a designation suffix.
BD	Bahlochnyy Derzhahteli – beam-type [weapons] rack for 'Backfire'.
CAHI	See TsAGI.
CFE	Conventional Forces in Europe, arms limitation agreement.
cg	Centre of Gravity.
CIS	Commonwealth of Independent States.
c/n	Construction number.
Comint	Communications Intelligence.
D	Dahl'niy – IFR-equipped (literally long range); as a designation suffix.
DA	Long Range Aviation, Division of VVS.
DBAP	Dahl'niy Bombardeerovochnyy Aviapolk – long range bomber regiment or heavy bomber wing.
ECM	Electronic Counter-Measures.
Elint	Electronic intelligence.
F	Fyuzelyazhnyy – air-launched weapons, fuselage-mounted; as a prefix.
f/n	Fuselage number.
g	Gravitational pull, ie 1g = the gravitational force experienced on Earth, 7g is seven times this.
GKAT	Gosoodahrstvennyy Komitet po Aviatseeonnoy Tekhnike – State Committee for aviation hardware
GLIT	Gosoodahrstvennyy Lyotno-Ispytahtelinyy – State Flight Test Centre named after Valeriy P Chkalov Tsentr, at Akhtoobinsk: formerly NII.
HE	High Explosive.
HSU	Hero of the Soviet Union.
I	Izdeliye – product or item; as a designation prefix.
IAS	Indicated Air Speed.
IFF	Identification, Friend or Foe.
IFR	Instrument Flight Rules, 'heads down' flying in poor or no visibility.
IFR	In-Flight Refuelling, see D and PT.
IOC	Initial Operational Capability.
IR	Infra-Red.
IRCM	Infra-Red Counter-Measures.
JATO	Jet-Assisted Take-Off, see SRPD.
K	Kompleks – fitted with a weapon system, eg Kh-22 on the Tu-22K [vo'orouzheniya]; as a designation suffix.
K	'Koob' – fitted with the (Cube) Sigint pack; as a designation suffix; eg Tu-22RK.
K	Kryliyevoy – wing-mounted air-launched weapons; as a prefix.
kN	KiloNewton, SI measurement of force (or thrust). 1kN = 224.8lb = 101.96kg of static thrust.
LERX	Leading Edge Root eXtension.
LII	Lyotno-Ispytahte'nyy Institoot – flight research institute named after Mikhail M Gromov at Zhukovsky.
LL	Letayuschchaya Laboratoriya – flying laboratory or test-bed; as a designation prefix.
M	Modifitseerovannyy – modified; as a designation suffix.
MER	Multiple Ejection Racks.
MLU	Mid-Life Update.
MTBF	Mean Time Between Failures.
MTOW	Maximum Take-Off Weight.
NII VVS	Nauchno-Ispytahte'nyy Institoot – Soviet Air Force Research Institute at Akhtoobinsk – see GLITs.
OGDRAP	Otdelinyy Gvardeyskiy Dahliniy Razvedyvatelinyy Aviapolk – Independent Guards Long Range Recce Regiment, or strategic reconnaissance wing.
OKB	Opytno-konstrooktorskoye Byuro – Design bureau: (OKB-23 – Myasischchev, OKB-36 – Rybinsk, OKB-155 – Mikoyan, OKB-156 – Tupolev.)
OPB	Opteecheskiy Bombardirovochnyy Preetsel – optical bomb sight.
P	See PP.
P	Passivnoye Samonavedeniye – passive radar homing; as a designation suffix.
Photint	Photographic intelligence.
PP	Postanovschchik Pomekh – ECM aircraft; as a designation suffix, on 'Blinder' shortened to Tu-22P.
PT	Preeyomnik Topliva – Telescopic IFR probe .
R	Razvedchik – reconnaissance; as a designation suffix.
RHAWS	Radar Homing and Warning System.
RKBM	Rybinsk engine design bureau.
rpm	Rounds per minute (of a gun or cannon).
RWR	Radar Warning Receiver, see SPO.
SARH	Semi-Active Radar Homing.
SFC	Specific fuel consumption, rate of fuel burn per unit of thrust.
SHORAN	Short range air navigation (system).
Sigint	Signals intelligence.
SLAR	Sideways-looking Airborne Radar.
sm	Statute miles, Imperial measurement of length, 1sm = 1.6km.
SOR	Specific Operational Requirement.
SPO	Sistema Predooprezhdeniya ob Obloochenii – Irradiation warning system, or RWR.
SPRD	Startovyy Porokhovoy Raketnyy Dveegatel – Jet-assisted take-off (JATO) rockets.
Sh-1	Shtoormanskiy – as a designation suffix (on the Tu-134A), navigator trainer. See also UB-K and UB-L.
SPS	Stahntsiya Pomekhovykh Signahlov – Interference emitter (ECM equipment).
SSEP	'Standard Strap-on ECM Pod', see UKhO
TAS	True (or calibrated) airspeed.
TAU	Topografeecheskaya Aviatseeonnaya Oostanovka – Topographical aerial photography device.
TK	Tonkoye krylo – thin wing; as a designation suffix.
TOW	Take-off Weight.
TsAGI	Tsentrahl'nyy Aero- i Gidrodinameecheskiy Institoot – Central Aero and Hydrodynamics Institute.
TsNVU	Tsentrahl'noye – Navigatseeonnoye Vychisleetelinoye Oostroystvo; Central Navigational Computer.
U	Oochebnyy – trainer; as a designation suffix.
UBK	Kompleks [voiorouzheniya] – WSO trainer; as a designation suffix (on the Tu-134A). See also Sh-1 and UB-L.
UBL	Oochebno-boyevoy dlya lyotchikov – combat trainer for pilots; as a designation suffix (on the Tu-134). See also Sh-1 and UB-K.
UKhO	Oonifitseerovannyy Khvostovoy Otsek – standardised aft bay, palletised systems area on 'Blinder', called SSEP for ease.
UKU	Oonifitseerovannaya kormovaya oostanovka – standardised tail [gun] mount).
VA	Vozdooshnaya Armiya – Air Army, or air force .
VFR	Visual Flight Rules, flight with outside visual references.
VVS	Voyenno-vozdooshnyye Seely – Soviet Air Force
WSO	Weapons Systems Operator.

Tu-22 and Tu-22M Designations

VVS	OKB		Izdelye	ASCC
–	Tu-105	–	–	–
–	Tu-105A	–	–	–
Tu-22	–	–	–	'Blinder-A'
Tu-22A	'Yu'	'A'	–	'Blinder-A'
Tu-22R	'YuR'	'AR'	–	'Blinder-C'
Tu-22RD	–	'AD'	–	
Tu-22RK	–	'ARK'	–	
Tu-22RDK	–	'ARDK'	–	
Tu-22RM	–	'ARM'	–	
Tu-22RDM	–	'ARDM'	–	
Tu-22B	'YuB'	'AB'	–	'Blinder-C'
Tu-22U	'YuU'	–	–	'Blinder-D'
Tu-22UD	'YuUD'	'AUD'	–	
Tu-22K	'YuK'	'AK'	–	'Blinder-B'
Tu-22KD	–	'AKD'	–	
Tu-22P	'YuP'	'AP'	–	'Blinder-E'
Tu-22P-1	–	–		
Tu-22P-2	–	–		
Tu-22KP	–	'AKP'	–	
Tu-22KPD	–	'AKPD'	–	
Tu-22M0	–	–	45-00	'Backfire-A'
Tu-22M1	–	–	45-01	
Tu-22M2	–	–	45-02	'Backfire-B'
Tu-22M2ye	–	–	–	
Tu-22MP	–	–	–	
Tu-22M3	–	–	45-03	'Backfire-C'
Tu-22M3R	–	–	–	
Tu-22M3-LL	–	–	–	

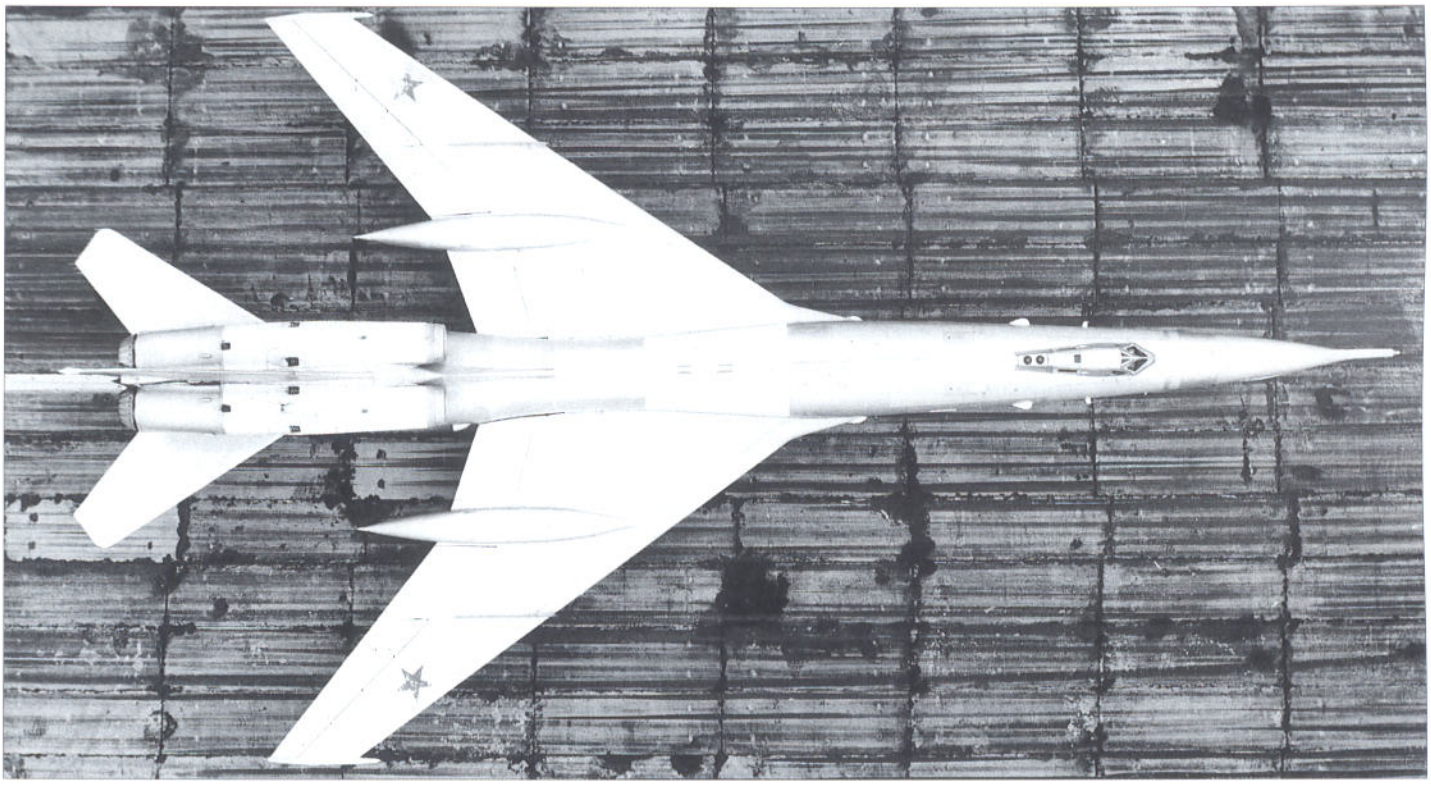
RUSSIAN LANGUAGE AND TRANSLITERATION

Russian is a version of the Slavonic family of languages, more exactly part of the so-called 'Eastern' Slavonic grouping, including Russian, White Russian and Ukrainian. As such it uses the Cyrillic alphabet, which is in turn largely based upon that of the Greeks.

The language is phonetic – pronounced as written, or 'as seen'. Translating into or from English gives rise to many problems and the vast majority of these arise because English is not a straightforward language, offering many pitfalls of pronunciation! Accordingly, Russian words must be translated through into a *phonetic* form of English and this can lead to different ways of helping the reader pronounce what he or she sees. Every effort has been made to standardize this, but inevitably variations will creep in. While reading from source to source this might seem confusing and/or inaccurate but it is the name as *pronounced* that is the constancy, if not the *spelling* of that pronunciation!

The 20th letter of the Russian (Cyrillic) alphabet looks very much like a 'Y' but in English is pronounced as a 'U' as in the word 'rule'. This is a good example of the sort of problem that some Western sources have suffered from in the past (and occasionally get regurgitated even today) when they make the mental leap about what they see approximating to an English letter.

Developing 'Blinder'



Superb plan view of a Tu-22P showing the 'coke bottle' area-ruled fuselage and the Tupolev 'hallmark' wing fairings for the undercarriage. Yefim Gordon archive

On 10th August 1954, the Soviet Council of Ministers and the Central Committee of the Communist Party issued a joint decree ordering the development of a long range supersonic bomber. The aircraft was allocated the designation Model 105 (Tu-105) and at the preliminary development (PD) stage, Sergey Mikhailovich Yeger was put in charge of the general arrangement team.

First studies were completed in November 1954, the result still looking a lot like the Tu-16; some internal documents even went so far as to designate it 'aircraft 105 based on the Tu-16'! It had new wings swept back 55° at quarter-chord and lacked the characteristic Tupolev main landing gear fairings beyond the trailing edge. VD-5F afterburning turbojets with raked air intakes were placed in nacelles along the fuselage sides all the way to the tail unit. The whole thing was moderately area-ruled at the wing/fuselage joint. Like the Tu-103, this configuration did not progress beyond the PD stage.

Model 105 (Tu-105) Experimental Bomber

Wind tunnel tests which began in late 1954 led quickly to major changes in the appearance of the Model 105. The engines were moved aft and mounted above the rear fuselage on a beefy pylon, and the centre fuselage was area-ruled – a must if supersonic speeds were to be attained. The area rule was given careful consideration; different ways of 'squeezing' the fuselage were tried in the wind tunnel.

The definitive configuration was selected in August 1955. The fuselage was 'squeezed' laterally and the wings had increased in thickness as the roots, housing the main gear bogies. This allowed the traditional Tupolev landing gear fairings to be eliminated, making the wings much cleaner aerodynamically, without impairing bomb bay capacity. Finally, a greater portion of the trailing edge could be used for high-lift devices, improving the lift/drag ratio both in take-off and landing modes and in cruise flight.

The rear engine arrangement ensured better operating conditions for the engines, allowing simple air intakes without a sophisticated boundary layer separation system to be used (the envisaged cruising speed was limited to Mach 1.5). On the other hand, this arrangement inferred a weight penalty of 10 to 15% because the forward fuselage had to be longer for centre of gravity (cg) reasons; besides, the longer nose would have an adverse effect on yaw and pitch stability.

The spread of weight along the fuselage caused huge inertia forces which meant the control system had to be designed very carefully (as the designers found out – the hard way). Finally, the thrust line was way above the fuselage axis, resulting in a pitch down force which had to be compensated in all flight modes, especially on take-off when the engines were running at full power. The Tupolev Opytno-konstrooktorskoye Byuro (OKB – design bureau) and the Voyenno-vozdooshnyye Seely (the Soviet Air Force – VVS) agreed that the Tu-105 would be a multi-mode aircraft. The lift/drag ration would be 10 or 11 in subsonic mode and 5 at Mach 1.5.

The expected specific fuel consumption (SFC) of the VD-7M was about 1.9 to 2.1kg/kgp hour in reheat mode and about 0.9kg/kgp hour at full military power – pretty much the same as the General Electric J79-GE-3B of the Convair B-58 Hustler. The two aircraft were similar in fuel economy, but the B-58 had a higher cruise

Mach number than the Tu-105; thus, Convair had ended up with an aircraft optimised for supersonic cruise but unable to fully use its potential in this mode. The Soviet designers and the VVS set forth more modest requirements for Mach numbers, and the result was a more rational aircraft.

Other possible engines considered at the PD stage included the Zoobets RD16-17F, Mikulin AM-17F and Dobrynin VD-9F, but none of them got beyond the proposal stage. More serious consideration was given to the Kuznetsov NK-6 afterburning turbojet rated at 196kN (44,091lb st) reheat as a way of increasing the top speed (the projected Kuznetsov-powered version, was designated Tu-106 and is described separately). The designers soon realised that simply fitting larger engines would not do the trick; refining the aircraft's aerodynamics, especially the supersonic air intake design, was also necessary. NK-6 development was taking rather longer than anticipated and the Kuznetsov engine was rejected as well, leaving the VD-7M as the definitive powerplant.

The sleek Tu-105 was certainly an impressive machine. The long pointed fuselage, sharply swept wings and unconventionally located engines showed clearly that this was indeed a fast jet. The high speed/low drag requirement resulted in that, for the first time on a Soviet bomber, the navigator/bomb aimer had no direct forward vision, relying mostly on instruments. These included the R-1A 'Rubin-1A' (Ruby – pronounced 'roobin') ground mapping radar (ASCC reporting name 'Short Horn') located immediately in front of the navigator in a dielectric fairing forming the lower half of the fuselage nose; the navigator's compartment glazing was limited to four lateral windows. The pilot sat under an extremely small fighter-style canopy with a V-shaped windscreen which gave little drag but did not afford much in the way of visibility either.

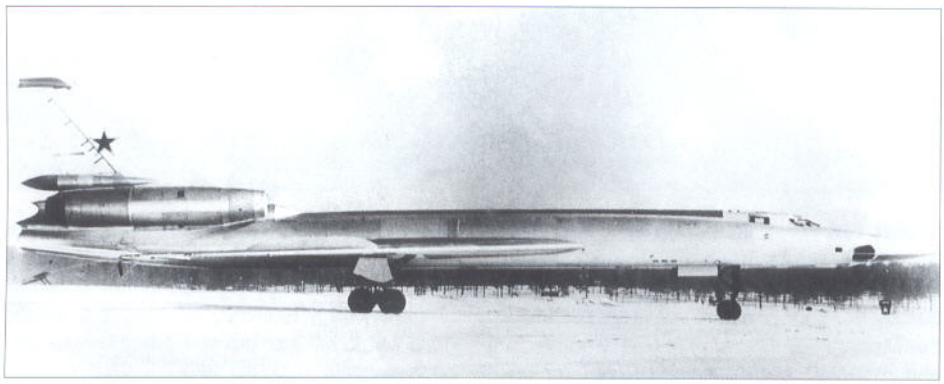
The bomber's high speed meant that an attack by enemy fighters was possible only from the rear hemisphere. Thus, the defensive armament consisted of two 23mm (0.90 calibre) AM-23 guns in a powered tail barbette. This was aimed by a PRS-2 'Argon' gun ranging radar located directly above the engine nozzles and by a TP-1 (Televizionnyy Preetsel) TV sighting system at the top of the fin – a novel feature for Soviet bombers. The guns were fired by the gunner/radio operator who sat behind the pilot, facing aft; two small lateral windows were provided to prevent his workstation from getting too claustrophobic.

All three crew members sat on specially-developed K-22 ejection seats ejecting downwards which doubled as 'crew lifts' for embarkation and disembarkation. The downward ejection system offered a substantial weight saving but imposed a severe limit on minimum ejection altitude.

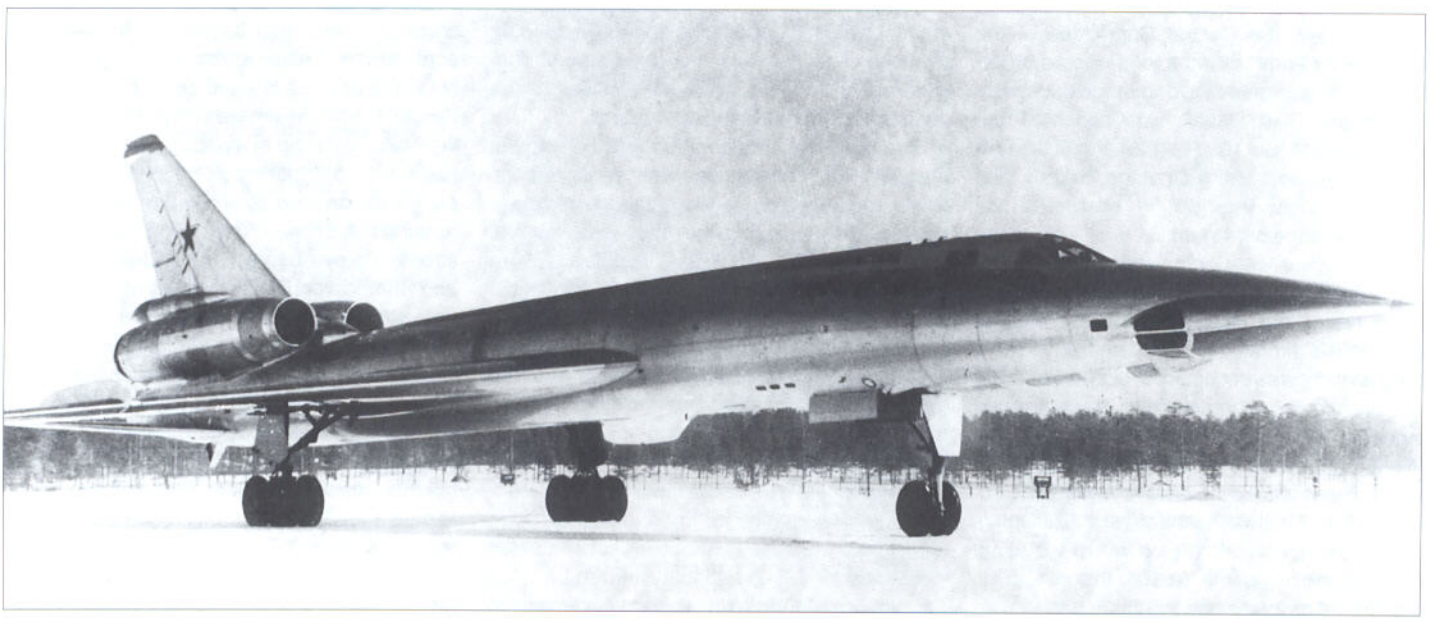
The control system incorporated quite a few novel features. Conventional elevators would be inefficient at high speeds, so the Tu-105 was fitted with slab stabilisers. All control surfaces had irreversible hydraulic actuators and the control system featured an artificial 'feel' unit. There was also a conventional mechanical backup control system which could be used at up to 550 to 600km/h (341 to 372mph) indicated airspeed.

Construction of the first prototype Tu-105 began in late 1955 at the Tupolev OKB's experimental plant No.156 on Radio Street in the middle of Moscow, later named 'Opyt' (which can be translated as either 'experiment' or 'experience'). Changes were made constantly during construction because many design problems had to be tackled as they came. Therefore, construction dragged on until December 1957 when the still incomplete aircraft was dismantled and trucked to Tupolev's flight test facility at the Lyotno-Ispytahte'nyy Institoot (LII) in Zhukovsky. There it sat for another six months while the missing equipment items were procured and installed; it was not until June 1958 that systems and taxi tests commenced.

Finally, on 21st June 1958, the Tu-105 made its first flight at the hands of test pilot Yuri T Alasheyev, test navigator I E Gavrilenko and gunner/radio operator K A Schcherbakov. The initial flight test programme (factory test programme, in Russian terminology) proved to be brief. The forward fuselage was damaged in a crash landing when the nose gear failed to extend. Though clearly repairable, the aircraft was struck off charge since the much-improved second prototype (the Tu-105A) was ready for testing by then. The hulk of the Tu-105 lay on the LII dump for several years until scrapped.



Two views of the 'Type 105', first prototype of the Tu-22 series. Tupolev OKB archive



Model 105A (Tu-105A) – Tu-22

The official directive on the Tu-105A was issued in April 1958; however, early design work on it had started in August 1957 when the first prototype was still unflown. Two basic versions of the Tu-105A were envisaged, powered by VD-7M and NK-6 turbojets respectively. With the latter powerplant, the aircraft was to reach Mach 2; however, this version (the Tu-106) was eventually abandoned due to protracted development of the engine. Optimising the NK-6, especially in the supersonic cruise mode, could slow the aircraft's development considerably.

The Tu-105A differed markedly from the first prototype. For an obscure reason, the designers had reverted to Tupolev's 'trademark' landing gear arrangement with aft-retracting main gear bogies rotating through 180° to lie inverted in prominent fairings protruding beyond the wing trailing edge.

Part of the equipment was relocated to the pressurised crew cabin to make room for additional fuel (cell No.1). The big No.2 fuel cell was located aft of an unpressurised equipment bay housing, among other things, an AFA-34-OK strike camera. The No.3 fuel cell above the wing centre section was retained while another below the centre section was deleted, and the wing and centre section fuel tank group (No.4) was rearranged. The aft fuselage fuel capacity was increased and the number of fuel cells located there was reduced to three (Nos.5, 6 and 7). As a result, the fuselage ended up looking rather fatter than the Tu-105's.

The engine nacelles were extended aft and fitted at a small 'toe-in' angle, and the fairing between the nozzles was recontoured. The gun ranging radar (which, incidentally, was new – the PRS-3 'Argon-3') was moved down to just under the nozzles, ie directly above the tail barbette, and the TP-1 TV sighting system was relocated to the radar's original position. The aircraft mounted an all-new DK-20 tail barbette with a single 23mm R-23 gun (a twin-gun installation as on the first prototype was originally envisaged). The nose contours and navigator's glazing were revised and other minor changes made to the airframe and systems.

The Tu-105A was designed to have nuclear capability from the start. To this end the bomb bay featured a temperature control system, the crew compartment incorporated biological shielding and the under surfaces were to have a reflective white finish as a protection against the flash of the nuclear blast.

A A Rikhter's R-23 gun, or Izdelye 261P (pronounced izdayliye, – 'product', or 'item', a standard code for various military hardware items), was a truly unique weapon. Thanks to an unusual loading arrangement and a number of novel features of the gun itself and the rounds, the rate of fire was an astonishing 2,500rpm – a record-breaking figure for a single-barrelled aircraft gun. The R-23 was a simple and reliable weapon and a very compact one; the latter feature was important since it reduced drag when the gun was traversed at supersonic speed.

The electrohydraulically-powered DK-20 gun barbette was developed by a team of the 'Vympel' (Pennant) plant under Deputy Designer-in-chief N A Roobin. The barbette traversed and elevated automatically to compensate for the aircraft's speed and motion relative to the target, ensuring accurate aiming at high gun traversing/elevation rates.

The barbette and its numerous subsystems proved quite tricky to fit into the cramped aft fuselage of the Tu-105A. Integration of the barbette into the airframe was performed by Tupolev's armament group led by D A Gorskiy and A V Nadashkevich (the latter was head of the group). Various components of the barbette's control system were dispersed in the pressurised crew compartment at the gunner's station (fuselage frames Nos.10 through 13), in the nosewheel well (frames Nos.18 through 20) and in the tailcone (frames Nos.81 through 85).

Two Tu-105As were built – a flight test aircraft (the second prototype) and a static test airframe. Assembly of the former began at factory No.156 in January 1958 and the aircraft was completed by mid-1959. On June 12 it was delivered to LII and formally handed over to Tupolev's flight test facility three days later following reassembly. The crew assigned to the Tu-105A was the one that had flown the original Tu-105 prototype - pilot Yu Alasheyev, navigator I Gavrilenko and gunner/radio operator K Schcherbakov. Yuri G Yefimov was assigned project engineer of the test programme. After a month of systems checks and modifications, the aircraft commenced taxi trials on 8th August and made its first flight on 7th September 1959.

On 21st December 1959 the Tu-105A crashed on its seventh flight, killing the pilot and navigator. Schcherbakov, the sole survivor, recalled that the objective of the flight was to check out the aircraft's handling at speeds between Mach 1.1 and Mach 1.5. The Tu-105A took off from Zhukovsky at 11am, heading towards Penza; on reaching 7,000m (22,965ft) the pilot was to climb in full afterburner to 10,000m (32,808ft). After that the flight plan prescribed making level runs at 650 to 900km/h (403 to 559mph) IAS, then checking rudder and elevator response at 10,000m, 8,000m (26,246ft), 6,000m (19,685ft), 4,000m (13,123ft) and 2,000m (6,561ft), pulling 0.5 to 1.5g.

At first everything went smoothly. The bomber met a Tu-107 (a military transport version of the Tu-104A 'Camel' airliner which did not progress beyond the prototype stage) cruising above them at 7,000m (22,965ft) on a test flight. When the Tu-105A had climbed to 7,000m Alasheyev engaged the afterburners and climbed to 10,000m; this had to be repeated because the aircraft had exceeded Mach 1 on its first run which ran contrary to the flight plan. After that, the bomber made the first level run at 950km/h (590mph) true airspeed while flight and test instrument readings were being filmed on cine camera.

Suddenly there was a loud popping noise and the aircraft began to shake violently at about five oscillations per second, dropping the nose and rolling right at the same time. 'Yura, what's that? Engine surge?', Gavrilenko asked. He repeated the question twice but Alasheyev did not respond. Gavrilenko started calling out, 'Watch the bank angle, Yura. Watch the bank angle.' The aircraft was plunging earthwards in a death dive, slowly rolling and accelerating.

'Prepare to eject', Alasheyev finally ordered; Schcherbakov jettisoned his entry hatch and awaited further orders. A minute later, seeing that the aircraft was diving almost vertically, he ejected without command. The accident investigation board later established that the bomber was doing 1,380km/h (857mph) at the moment of ejection – well above the maximum ejection speed.

The slipstream knocked his head forward and the visor of his helmet was gone in an instant. The seat was falling back downwards (the gunner sat facing the tail) and he could not separate from it, even though the seat belts had been released automatically, so great was the pressure of the slipstream. He kicked the seat several times, but to no avail. Finally he shoved it violently with his shoulder; that did the trick. The seat fell away and Schcherbakov opened his parachute, landing painfully in a tree not far from the crash site.

A young man from a nearby village came by and Schcherbakov asked if he had seen anybody else. The answer was 'No. There was a mighty explosion'. Schcherbakov had not heard the blast from above but he did see smoke rising from the forest and some strange objects floating earthwards, glinting in the sun. These were fragments of the Tu-105A's aluminium skin; the aircraft had disintegrated utterly on impact. Indeed, Schcherbakov had been extremely lucky to survive an ejection at supersonic speed, as the seat back had shielded him from the slipstream. Gavrilenko, the navigator, who ejected first, was not so lucky. He was facing forward with virtually nothing to protect him and the slipstream literally tore him apart. Alasheyev never ejected, trying desperately to save the prototype.

The Tu-105A had come down in a wooded area near the Ryazan to Sasovo road, and it took the investigating team more than 24 hours to reach the crash site from Zhukovsky. What they saw was a crater 25 to 26m (82 to 85ft) in diameter and 7 to 8m (23 to 26ft) deep. For two weeks the 'tin kickers' prowled the woods, collecting pieces of wreckage and other evidence. Unfortunately, nature had turned against them; thawing periods were succeeded by periods of intense cold, and heavy snowfall obscured parts of the aircraft.

Some fragments were retrieved from the local population which had been quick to take possession of the windfall of metal bits and pieces, believing they might come in handy. The villagers were reluctant to hand the fragments back for nothing, believing that 'finders are keepers', so the wreckage was purchased

from them at a nominal price. Fragments of Alasheyev's unused parachute were found, among other things.

The loss of the brave and highly skilled test crew, not to mention the aircraft, was a severe blow to the OKB. Yuri Alasheyev was later posthumously awarded the title of Hero of the Soviet Union – the highest Soviet decoration – for his bravery and his contribution to the development of new Soviet aircraft. Since the crash was clearly caused by a technical problem, finding and eliminating it was a top priority task because aircraft factory No.22 in Kazaní was already gearing up for production of the type under the service designation Tu-22.

(Incidentally, the designation had been used earlier for the projected three-engined Tu-74 reconnaissance aircraft of 1947 - a forerunner of the Tu-14 'Bosun' [Tu-81] bomber and the Tu-82 twinjet bomber of 1948 which did not get beyond the prototype stage. Thus, the Tu-105A was the Tu-22 're-revisited'.)

On January 3, 1960 the Gosoodahrstvennyy Komitet po Aviatseeonnoy Tekhnike (State Committee for Aviation Hardware – GKAT) appointed an investigating board chaired by A I Makarevskiy, head of the Tsentrahl'nyy aero- i Gidrodinameecheskiy Institoot (Central Aero and Hydrodynamics Institute – TsAGI) to ascertain the cause of the crash. While the exact cause was never found, the board focused on five probables, namely structural failure, flutter, excessive dynamic loads during deceleration (when the afterburners were switched off at transonic speeds), engine surge, and landing gear doors breaking away and damaging other parts of the aircraft.

The investigation act was drawn up in February, whereupon the OKB set to work making changes to the Tu-22 in all five possible problem areas. These modifications were made and tested on the first production bombers rolling off the production line in Kazaní.

The specifications of the Tu-105A as per advanced project documents are given in the table, the actual data were slightly different.

As flight tests progressed the Kazan' factory manufactured tooling and jigs, preparing for large-scale production. (It may sound risky, but it was fairly common in the USSR at the time to launch production of new military aircraft which had not yet been tested fully, much less cleared for service; this practice was one of the 'side effects' of the arms race.) At plant No.22 the aircraft bore the internal product code 'Aircraft Yu' (the last-but-one letter of the Cyrillic alphabet).

The first production Tu-22s incorporated a number of revisions made in the wake of the second prototype's crash. The slab stabilisers were reinforced and their tips angled for better flutter resistance, and faired anti-flutter weights were fitted to the wingtips. The engines were slightly raised to improve operating conditions at high alpha (or angle of attack - AoA - the attitude of the aircraft to the horizontal plane), preventing boundary layer ingestion and reducing the risk of surge.

Tu-105A Specification

Wingspan	23.6m	77ft 7.5in
Length	42.2m	138ft 5.4in
Height on ground	9.5m	31ft 2.0in
Wing area: minus LERXes	151.23 m²	1,626.29ft²
Wing area: with LERXes	162.25 m²	1,744.62ft²
Stabiliser area	40.0 m²	430.1ft²
Vertical tail area	22.01 m²	236.66ft²
Stabiliser span	10.0m	32 ft 10in
Wing aspect ratio	3.7	
Wing taper	3.68	
Wing anhedral	2.5°	
Wing incidence	1°	
Wing sweep at quarter-chord	52° 14' 30"	
Landing gear track	9.12m	29ft 11.0in
Landing gear wheel base	14.36m	47ft 1.35in
Maximum take-off weight	85,000kg	187,390lb
Take-off run at MTOW		
– in full afterburner	1,950m	6,400ft
Landing run	at 53,000kg	116,843lb
	1,370-2,500m	4,494-8,202ft
Top speed at gross weight	63,000kg	138,888lb
– full military power	at 5,000m	16,404ft
	1,175km/h	730mph
– full afterburner	at 10,000m	32,808ft
	1,510km/h	938mph
Range at cruising speed	950km/h	(590mph)
	5,850km	3,635sm
Service ceiling at gross weight		
	63,000kg	138,888lb
– at full military power	11,700m	38,385ft
– in full afterburner	14,700m	48,228ft
Bomb load		
– normal	3,000kg	6,613lb
– maximum (overload condition)		
	9,000kg	19,841lb
Crew	3	

After these changes production really got under way. Tupolev OKB designer Dmitriy Sergeyevich Markov was appointed Tu-22 chief project engineer, taking charge of all further development. Various specialised versions of the Tu-22 were envisaged at an early stage, and these are detailed below.

Tu-22A Long Range Bomber ('Aircraft Yu'/'Aircraft A')

The initial production version was designed to deliver both conventional and nuclear free-fall bombs day and night in visual flight rules (VFR) and instrument flight rules (IFR) conditions. The 'Aircraft Yu' factory code was changed to 'Aircraft A' in the late 1960s.

The Tu-22A, as this version was called, was ordered into production by a directive of the Council of Ministers dated 17th April 1958. (In keeping with the contemporary Soviet system of designating bombers, the 'A' suffix denoting ahtomnyy or nuclear[-capable]). The bomb bay was equipped with appropriate fixtures and a climatic system with electric heaters keeping the temperature within the required limits of +15 and +25°C, nuclear munitions being delicate and sensitive to temperature changes.

Between August and December 1959, plant No.22 had turned out five initial production aircraft (manufacturer's fuselage numbers – f/n – 101, 102, 201, 202 and 203) which were virtually identical to the Tu-105A. After the loss of the latter, however, production was promptly suspended pending investigation of the crash. Within the six months that followed the crash, Markov and other Tupolev and Kazan' factory engineers made numerous design changes as detailed above, based on the rather vague findings of Makarevskiy's investigation board; these changes were a must if such tragedies were to be avoided in service.

Consequently, initial production bombers were converted to verify these changes. The first three Tu-22As (f/ns 101, 102 and 201) arrived in Zhukovsky on 14th July, 21st August and 20th August 1960 respectively. Pilot Aleksandr Danilovich Kalina and crew chief Oleg I Belostotskiy were assigned to f/n 101, pilot Nikolay N Kharitonov and crew chief L G Gladoon to f/n 102 and pilot V F Kovalyov and crew chief L A Yumashev to f/n 201. The first two aircraft were earmarked for performance testing and handling trials, including high alpha tests and systems checkout on f/n 102. The third aircraft served for weapons trials.

Meanwhile, plant No.22 kept producing Tu-22s, including prototypes of the new Tu-22R, Tu-22K, Tu-22P and Tu-22U versions. Twenty units were built in 1960, including ten Tu-22As.

Kalina's crew was the first to take to the air on 7th July 7 1960, followed by Kharitonov on 2nd September and Kovalyov on 3rd November. Kharitonov's navigator was V S Pasportnikov and the gunner/radio operator was none other than K A Schcherbakov, the sole survivor of the second prototype's crash.

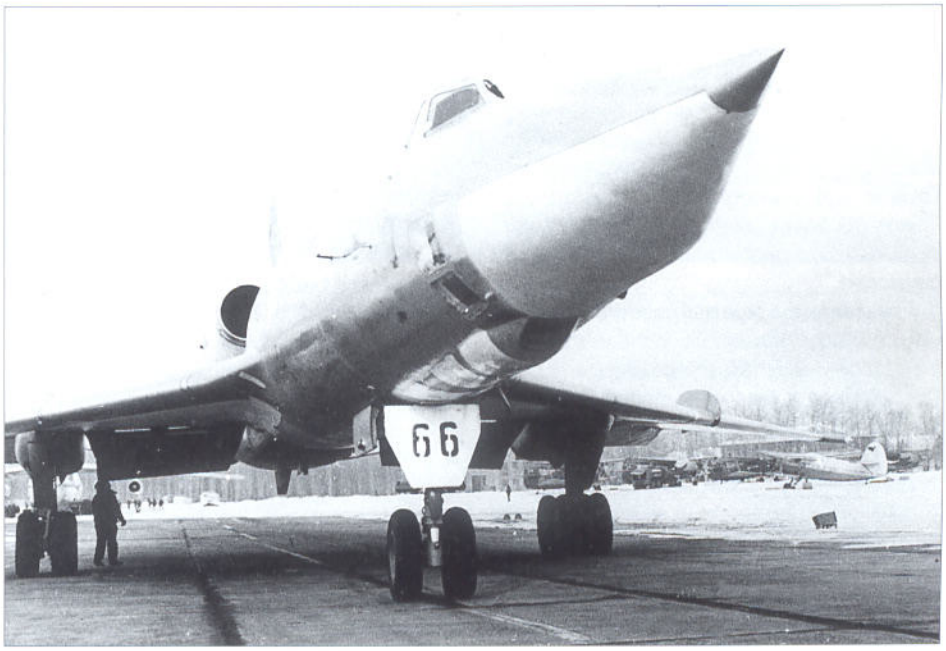
Early test flights showed that the Tu-22 was quite a handful. Immediately after take-off it was extremely prone to 'seesawing', ie pitch oscillations with increasing momentum, and great care was needed to coax it into a stable climb. Ground crews watching these spectacular take-offs said it looked frightening. Incidentally, Alasheyev had reported a similar control problem with the Tu-105A but the designers just did not have time to deal with it before the aircraft was lost. Now was the time to do something about it before somebody else crashed.

During this critical period Tupolev came to the LII airfield before each flight of the Tu-22 to talk to the crews and gather information on the oscillations. He suggested suspending the flights for a while and making a series of high speed runs; however, he knew as well as anyone else that the control system needed major modifications and the cure could only be found in the air. However, even before the Tu-105A had its first flight, OKB engineers had built a simple analogue simulator; Alasheyev had made several 'sorties' in it before flying the real thing. This simulator came in handy when refining the Tu-22's control system.

At a debriefing of a sortie of f/n 201, Tupolev chaired the session, and his long-time aide Aleksandr Aleksandrovich Arkhangelískiy and project chief Markov were present. The crew members made their reports, Tupolev asked what the unstick speed was and how the aircraft handled during climb out and turns.

All was pretty much business-as-usual until Tupolev addressed test pilot V F Kovalyov: 'I'll

Above: **Tu-22R on take-off. The nosewheel doors are just closing and the main units are retracting rearwards into their fairings.** Yefim Gordon archive



Right: **Forward view of a Tu-22R. Ilyushin Il-76 'Candid' and Antonov An-2 'Colts' in the background.** Yefim Gordon archive

tell you what, Valentin, let's go fly. Take a seat across the table from me, put your arm on the table, close your eyes and imagine my hand is the control column. Move the throttles forward, let the navigator call off the speed and let me feel the control forces you feel in various flight modes.'

After a prolonged session of arm-wrestling in this fashion the designer-in-chief made specific decisions on changes to be made to the control system. Using data accumulated in the test flights and Tupolev's intuitive approach, the dampers and artificial-feel units installed in the control circuits were modified. This was a major effort which kept the aircraft grounded until mid-November. It all paid off, however, when Kovalyov made the first post-modification flight on 17th November 1960 – there was no sign of the tell-tale 'seesaw effect'.

Yet that mission very nearly ended in disaster; hardly had one problem been tackled than another appeared. After a brief flight to check out the aircraft's handling Kovalyov requested permission to make a high speed run over the airfield before coming in to land. The Tu-22A was on short finals, coming in from the north past the neighbouring Bykovo airport at 400 to 500m (1,312 to 1,640ft) when the crew felt the bomber jerk. LII test pilot M Kirzhayev flying the MiG-17 'Fresco' chase-plane reported that flames and black smoke were streaming from the bomber's port engine. Kovalyov shut down the burning engine, but as he did so the sink rate increased and he realised he would not make it on one engine.

At 300m (984ft), seeing the steep bank of the Moskva river directly ahead, Kovalyov cheerfully announced over the intercom, 'Well, folks, that's it. Get ready to crash.' The crew strapped themselves in tighter for the impact and prepared for the worst while the airspeed bled off and the aircraft continued losing altitude, shaking so violently that it seemed to be on the verge of breaking up in mid-air.

Radio operator Schcherbakov (who had persuaded Tupolev to let him stick with the Tu-22 and not to transfer him to transports) called out calmly by radio to ground control, just before the impact, asking them to send an ambulance and a fire engine.

These were the last words navigator V S Pasportnikov heard – or so he thought then. He was knocked out cold by the landing, regaining consciousness in hospital several hours later when doctors hastily summoned to Zhukovsky by Tupolev were checking him for broken bones with an X-ray machine.

The bomber impacted tail down, hitting a dyke along the River Pekhorka, a tributary of

the Moskva; the main undercarriage was ripped away and the aircraft rolled over on its back.

As it hit the opposite bank the fuselage broke in two ahead of the wings and the aft portion erupted in flames. The forward fuselage slithered along the ground, eventually coming to rest inverted some 400m (1,312ft) from the rest of the wreckage.

All entry hatches and cockpit windows were jammed by the twisting of the fuselage, trapping the crew. Seeing the glow of flames behind him and believing the entire aircraft was burning (which luckily was not true), Kovalyov decided to eject. This was sheer suicide but he thought that he would rather die that way than be slowly roasted in the cockpit. Fortunately, Schcherbakov persuaded him not to.

A local tractor driver was the first to appear on the scene and attacked the triplex bullet-proof cockpit glazing with an axe in a vain attempt to free the airmen. In a few minutes, a helicopter landed nearby, bringing a rescue team from LII. The navigator was rushed to hospital; incredibly, Kovalyov and Schcherbakov sustained nothing worse than bruises. For Schcherbakov this was the second close call within a year – on the same type of aircraft.

The cause of the fire was traced to an oil pipe which had cracked and broken near the oil pressure gauge, cutting off the oil supply and eventually causing the engine to disintegrate. Early VD-7Ms were generally plagued by leaky connections causing a high oil consumption. This could result in the engine running out of oil and an uncontained failure unless it was discovered and the engine shut down in time. Things got better later on, but still the defect persisted until the improved RD-7M2 was developed.

Incidentally, the pipe had chosen to fail at the worst possible location – in 'no man's land', at the joint between the fuselage and the nacelle. This triggered a bitter argument between the Tupolev OKB and the Rybinsk engine design bureau (RKBM) as to who was responsible for the failure. It went on until someone from Tupolev urged everyone to sit down and find the reason 'before the same thing happens again'.

The loss of f/n 201 did not halt the test programme. The first and second production aircraft continued flying; Kalina and Kharitonov expanded the speed envelope, adding Mach 0.1 with every sortie, and finally started venturing beyond the sound barrier. On one occasion, flutter was experienced on Kharitonov's aircraft at 11,000m (36,089ft) and Mach 1.2 (the test equipment readout said Mach 1.17).

Looking through the window, N F Mayorov, the gunner/radio operator, saw the anti-flutter weight at the end of the port wing wobbling up and down, faster and faster. Sensing that the wing might break off at any moment, he ignored subordination and yelled to the pilot to reduce speed immediately. As Mayorov did so, the whole aircraft started shaking violently; Kharitonov reacted instantly, throttling back half a second later and saving the aircraft from certain destruction. More modifications to the control system followed (a dry friction damper was added), and the aircraft behaved well at Mach 1+ from then on.

The Tu-22A had a production run of only 15 which never actually served with either the strategic bombing arm of the VVS – Dahlínyaya Aviatsiya (Long Range Aviation – DA) or the naval air arm (Aviatsiya Voyenno-Morskovo Flota – AV-MF). They were mostly used as trials aircraft; four were destroyed or damaged beyond repair in accidents and the rest went on to serve with VVS schools as ground instructional airframes. Two aircraft (f/ns 302 and 303) were used as equipment test-beds until retired. The sole surviving Tu-22A ('Red 32', f/n 505) is now on display at Monino near Moscow; it was used for armament trials after f/n 201 was lost.

After the Tu-22 was unveiled to the public (and Western observers) at the 9th July 1961 airshow at Moscow's Tushino airfield, the ASCC assigned the rather uncomplimentary reporting name 'Blinder'.

Tu-22R Long Range reconnaissance 'Aircraft YuR'/'Aircraft AR'

The Tu-22R (razvedchik) reconnaissance aircraft was the most numerous version of the 'Blinder'. Though designed for day/night photographic and electronic intelligence (Photint/Elint), it could be quickly converted to a nuclear capable bomber if the need arose, since the mission equipment was palletised. If appropriate equipment was installed the aircraft could also be configured for electronic countermeasures (ECM) duties.

The VVS request for a recce version of the Tu-22 dated back to August 1959. Trying to make the Tu-22 a truly versatile aircraft, the OKB conceived an advanced development project within a month. In September, the full-scale mock-up was converted to a representative Tu-22R configuration.

Unfortunately, the crash of the second prototype (Tu-105A), the ensuing investigation, the necessary modifications and tests of the first production bombers caused the Tu-22R programme to be put on the back burner. Three Tu-22R prototypes were built in 1960 (f/ns 403, 501 and 503) but it was not until May 1961 that they were duly accepted and delivered to LII for testing because modifications had to made based on the findings of the accident investigation board. Delays with the mission equipment were also a contributing factor.

The Tu-22R prototypes shared all the bugs of the early production bombers and more changes had to be made. The testing and debugging programme continued into 1963, and not altogether without incident. The first prototype (f/n 403) was lost on 9th October 1961 when the first compressor stage disc disintegrated on one of the engines.

Several production aircraft built in 1961 and 1962 were also used in the trials programme. (Factory No.22 delivered 28 Tu-22Rs within this time frame. Improvements were introduced in phases from batch to batch). Since the basic bomber was coded 'Yu' at Kazaní, the Tu-22R became 'YuR'; this was changed to 'AR' in the late 1960s. Later versions of the 'Blinder' were similarly coded and re-coded ('Yu' or 'A' plus the designation suffix).

Officially the Tu-22R was included into the VVS inventory in 1968 along with the other versions of the 'Blinder'; however, the type had actually achieved initial operational capability (IOC) with the VVS in late 1962 as the first version of the Tu-22 to see active service. The recce version stayed in production until late 1967; a total of 127 was built. The final five aircraft (probe-equipped Tu-22RDs belonging to batches 54 and 55) were delivered *sans* reconnaissance equipment, ie, as bombers, and thus designated Tu-22AD.

The Tu-22R could be fitted with the following camera models:

AFA-41/20	Plan-view camera, day sorties.
AFA-42/100	Oblique camera, day sorties.
AFA-42/20	Twin camera, day sorties.
AFA-40	Twin camera, day sorties.
NAFA-MK-75	Twin camera, night sorties.
FARM-2	Photo-adapter for photographing the radar screen picture.

(AFA = aerofotoapparaht - aerial camera)

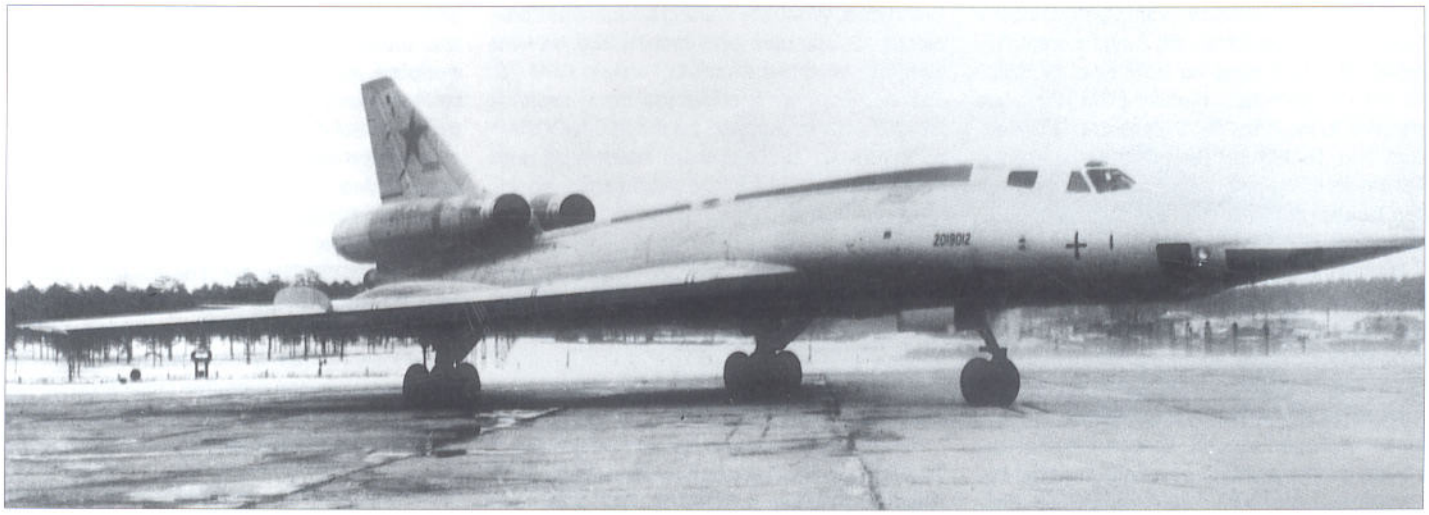
Tu-22R Camera Fit Options

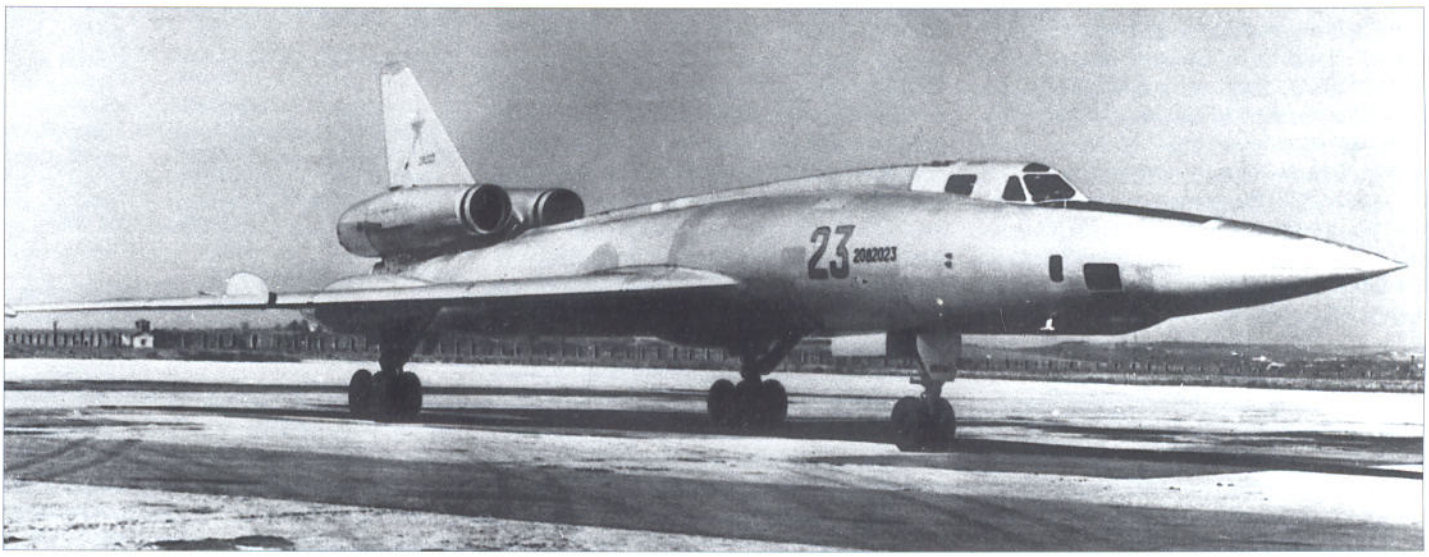
	Day Option 1	Day Option 2	Day Option 3	Night Option 4
AFA-41/20	1	1	1	–
AFA-42/100	1	1	1	–
AFA-42/20	2	2	2	2
AFA-242/100[1]	4	–	–	–
NAFA-NK-75	–	–	–	2
AFA-40	–	2	–	–
AFA-41/20[2]	–	–	1	–

[1] On AKAFU mount.
[2] On TAU-M mount – Topografeecheskaya Aviatseeonnaya Oostanovka – topographical aerial photography device.

The cameras were installed in the fuselage nose and the bomb bay. The Tu-22R could photograph large areas; eg, with AFA-42/100 cameras it could cover a strip 13km (8sm) wide and 600km (372sm) long. Other camera fits were even more impressive; AFA-41/20 and AFA-42/20 covered areas of 12 x 5,000km (7.45 x 3,105.5sm) and 40 x 3,000km (24.8 x 1,863.3 sm) respectively. Night cameras were installed in a special thermally stabilised capsule and were effectively a permanent fit; the remaining portion of the bomb bay was occupied by cassette-type racks for flare bombs – or conventional high explosive (HE) bombs if configured for the bomber role. Photint missions were flown at high or medium altitude.

Communications intelligence (Comint) and signals intelligence (Sigint) was performed by the SRS-6 'Romb-4A' (Rhombus) or SRS-7 'Romb-4B Elint pack; only the latter model was fitted from 1965 onwards. They could define

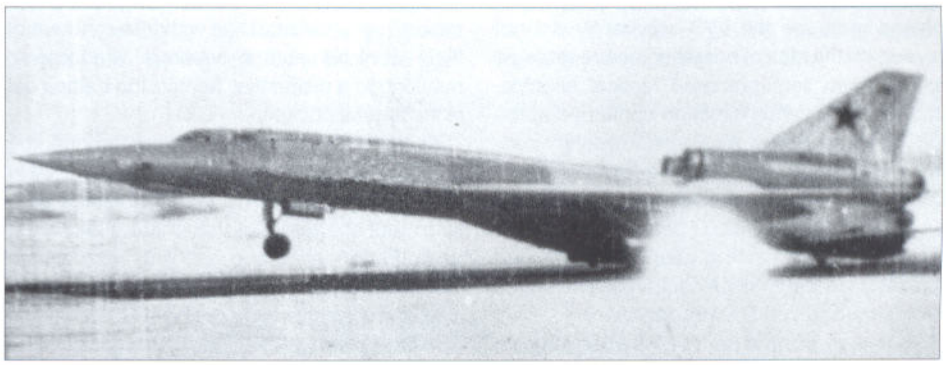




Top: **One of the first Tu-22Rs (2019012) with camera calibration cross on the nose.**
Yefim Gordon archive

Centre: **Tu-22R 2082023 '23' undergoing testing.**
Yefim Gordon archive

Right: **A poor, but nevertheless interesting, shot of a Tu-22R undergoing a rocket assisted take-off. It would appear that the retractable tail bumper is in contact with the runway.**
Yefim Gordon archive



and record up to 52 enemy radars operating in various wavebands.

Radar imaging was also possible by photographing the aircraft's ground mapping radar screen, using the FARM-2 adapter, further adding to the Tu-22R's reconnaissance methods. Voice information on targets seen by the crew could be taped by the MIZ-9 or MS-61 cockpit voice recorder.

All Tu-22Rs had provisions for use as a bomber, so a set of bomb racks came with each aircraft. Normally the aircraft were to carry conventional HE bombs weighing up to 3,000 kg (6,613lb) each; the maximum bomb load was 9,000kg (19,841lb). Alternatively, nuclear bombs could be carried; to this end the Tu-22R incorporated radiation shielding for the crew and had white-painted under surfaces. The navigator/bomb aimer used the OPB-15 or OPB-15V (Opteecheskiy Bombardirovochnyy Preetsel) optical bomb sight linked to the 'Rubin-1A' radar and AP-7MTs autopilot. Bombing was possible from low, medium and high altitude, day and night.

Like the Tu-22A, the Tu-22R was armed with a single R-23 gun with 500 rounds in a DK-20 tail barbette, targeted by means of a PRS-3 'Argon-3' gun ranging radar and a TP-1A (TP-1K) TV sighting system. Late production aircraft had an improved DK-21 gun barbette and a PRS-4 'Krypton' gun ranging radar.

The standard equipment included an SPS-3 'Roza' (Rose) ECM package (SPS – Stahntsiya Pomekhovykh Signahlov – interference emitter) in the unpressurised avionics bay. This could be used for individual or group protection (the ECM gear operated in concert during formation flight). Additionally, many Tu-22Rs were retrofitted with SPS-151, SPS-152 and SPS-153 ECM packs forming the 'Siren' (pronounced 'seeren' – lilac) suite. Part of the equipment was carried in the unpressurised avionics bay while the rest was housed in a long removable boat-tail fairing supplanting the regular gun barbette and associated radar. This fairing was known

as the UKhO (Oonifitseerovannyy Khvostovoy Otsek – standardised aft bay), hereinafter called 'standard strap-on ECM pod' or SSEP for ease of reference. (Similar ECM packages are fitted to the An-12BK-PPS 'Cub-D' ECM aircraft and Tu-95K-22 'Bear-G' missile carrier. For details of the latter see the Aerofax publication *Tupolev Tu-95/Tu-142 'Bear'* by Yefim Gordon and Vladimir Rigmant.)

Besides the above, the aft portion of the bomb bay housed an APP-22 'Avtomat-3' chaff dispenser (Apparaht Postanovki Pomekh, jamming device), and ASO-2B (KDS-16GM) 'Avtomat-2' chaff/flare dispensers were installed into the main gear fairings (as well as in the SSEP of 'Siren'-equipped aircraft). To warn the pilot that he was being 'painted' by enemy radars, the Tu-22R was fitted with a standard SPO-3 'Sirena-3' (pronounced 'seerayna' – siren) radar warning receiver; some aircraft were later refitted with the SPO-15 'Beryoza' radar warning receiver (RWR: 'Beryoza' or birch; SPO – Sistema Predooprezhdeniya ob Obloochenii – irradiation warning system).

Until 1965 all 'Rs were powered by the not-too-reliable VD-7Bs; these were replaced by VD-7Ms on late production aircraft. All early production Tu-22Rs were later re-engined with RD-7M2s in the 'Etalon' (Sample) mid-life update (MLU) programme.

The Tu-22R also had provision for four SPRD-63 (Startovyy Porokhovoy Raketnyy Dveegatel) jet-assisted take-off (JATO) bottles rated at 34.4 to 53.9kN (7,716 to 12,125lb st) each. These were to enable the 'Blinder' to use dirt strips; the possibility of operating from such strips was confirmed during tests using Tu-22R f/n 3004 in 1966 and the JATO bottles were recommended for service. While they never gained wide use the VVS apparently did not give up on the idea of operating heavy strategic aircraft from semi-prepared tactical airstrips, and research in this direction continued at the OKB and the Soviet Air Force Research Institute (Nauchno-Ispytahte'nyy Institoot – NII) for some time yet. Further trials at NII VVS with a Tu-22 fitted with two JATO bottles showed that the airframe and landing gear were subjected to excessive loads which could result in fatigue problems, and the idea was abandoned.

As new versions of the Tu-22 became known to the West the ASCC had to add suffix letters to the 'Blinder' reporting name. The Tu-22R was named 'Blinder-C' and the 'pure bomber' version became 'Blinder-A'.

Tu-22B Export Bomber Conversion 'Aircraft 'YuB'/'Aircraft AB'

In the early 1970s the Soviet government agreed to supply a handful of Tu-22s to 'friendly nations' in the Middle East – Iraq was the first export customer. Iraqi personnel was trained in the USSR by the 290th OGDRAP (Otdelínyy Gvardeyskiy Dahlíniy Razvedyvatelínyy Aviapolk – Independent Guards Long Range Recce Regiment; or strategic reconnaissance wing) at Zyabrovka airbase near Gomel' in Belorussia. When the training course was completed 12 bombers and two Tu-22U trainers were delivered to the Iraqi Air Force in 1974-75. The bombers were converted from 'second-hand' Tu-22Rs supplied by the 290th ODRAP by removing all equipment associated with nuclear capability, all reconnaissance equipment and installing different identification friend or foe (IFF) transponders. This bomber conversion was known as Tu-22B (Bombardeerovschchik) or 'Aircraft AB'. Iraqi 'Blinders' received a two-tone 'Middle East' camouflage scheme (Soviet Air Force Tu-22s had a natural metal finish, except for the white under surfaces on some aircraft).

Ten similarly downgraded bombers and two Tu-22UDs were delivered to the Libyan Arab Republic Air Force in 1976. The Iraqi and Libyan aircraft saw action – both in the Middle East and in Africa.

Tu-22U Trainer 'Aircraft YuU'

Tu-22 conversion training proved to be a complex affair and there was no way an instructor could be accommodated on a standard aircraft. This forced Tupolev to hastily develop a dedicated trainer version designated Tu-22U (Oochebnyy – pronounced rather like 'yoo-hoo' – trainer). Consequently, the type's factory code was Aircraft YuU'. The reason why it was never changed to 'AU' is probably because the Russian interjection 'aoo' is a call used when lost in the woods!

The specific operational requirement (SOR) for the Tu-22U was drawn up in 1960; the prototype (f/n 601) was completed same year and tested over the next two years. The trainer was based on the initial Tu-22A bomber. The gunner/radio operator's station was replaced by a raised instructor's cockpit with a second set of flight controls and a separate windscreen, resulting in a distinctive 'hump'; the trainee sat in the regular cockpit.

As there was no one to operate the gun, the gun barbette and associated equipment were deleted and replaced by a boat-tail fairing similar to (but shorter than) that of the 'Siren' ECM pack. Performance and handling were almost identical to those of the standard Tu-22R, except that range was 10% shorter because the instructor's cockpit reduced the capacity of the forward fuel cells.

Deliveries to the VVS began in 1963; a small number was exported to countries operating the bomber version (ie Iraq and Libya). About 30 Tu-22Rs and Tu-22Us were operated by the AV-MF in 1963. The Tu-22U received the reporting name 'Blinder-D'.

Tu-22K Missile Strike Aircraft 'Aircraft YuK'/'Aircraft AK'

Work on the Tu-22R reconnaissance version and the Tu-22P ECM version progressed in parallel with the basic bomber. The version to which both Tupolev and the VVS attached prime importance was the Tu-22K strike aircraft with the Kh-22 (ASCC – AS-4 'Kitchen') stand-off air-to-surface missile. Together, the aircraft and missile formed the K-22 (or Tu-22K-22) weapons system (K for kompleks; which was habitually used for Soviet naval missile carriers, eg Tu-16K-11-16, Tu-95K-20 etc.).

Development of the K-22 weapons system was initiated by a decree of the Council of Ministers on 17th April 1958. This document envisaged two basic versions if the Tu-22K powered by NK-6s or VD-7Ms; the manufacturer's being Tu-106K and Tu-105K respectively. Curiously, the stillborn Tu-106K was designated by the above decree as a 'first choice', with the Dobrynin-powered aircraft as 'insurance'.

Tu-22Us with VD-7M Engines

Maximum take-off weight	85,000kg	187,389lb
Empty operating weight	45,320kg	99,911lbs
Maximum landing weight	56,000kg	123,456lb
Fuel load	39,060kg	86,111lb
Top speed	at 11,000m	36,089ft
	1,385km/h	860mph
	1,500km/h*	932mph*
Effective range	5,000–5,130km	3,106–3,187sm
Service ceiling	12,500m	41,010ft
– in full afterburner	13,250m*	43,471ft*
– at full military power	10,000m	32,808ft
Take-off run	at 85,000kg	187,389lb
	2,270m	7,447ft
Landing run with brake parachutes		
	1,350–1,700m	4,429–5,577ft

* = late production aircraft with RD-7M-2s.

The armament – a single Kh-22 – was identical for both options. The required combat radius was 2,500 to 2,800km (1,553 to 1,739 sm) if the aircraft cruised at 950 to 1,000km/h (590 to 621mph), or 1,200 to 1,500km (745 to 932sm) if the aircraft cruised at 1,300 to 1,400 km/h (807 to 869mph). The missile would be launched within 300 to 400km (186 to 248sm) of the target at 10,000 to 14,000m (32,808 to 45,931ft). The system was to be submitted for state trials in the first quarter of 1961.

The Tupolev OKB was assigned responsibility for the entire K-22 weapons system, including the missile, which was not a Tupolev product. The missile was developed by a division of the Mikoyan design bureau (OKB-155) led by Aleksandr Yakovlevich Bereznyak. This later became an independent establishment which is currently known as the 'Raduga' (Rainbow) design bureau. The guidance system was designed by the KB-1 bureau of the Ministry of Electronics Industry.

At a later stage, range was to grow to 800 to 900km (497 to 559sm), providing the guidance system was upgraded. The missile was carried semi-recessed in the bomb bay on a BD-294F pylon; the bay was closed by four inward-opening doors once the missile had been launched.

The Kh-22 had semi-active radar homing (SARH), so a new search/target illumination radar designated PN (ASCC 'Puff Ball') was installed in the nose. It had a much larger scanner than the R-1A, requiring a characteristic bulged radome which was the Tu-22K's main identification feature. Changes associated with

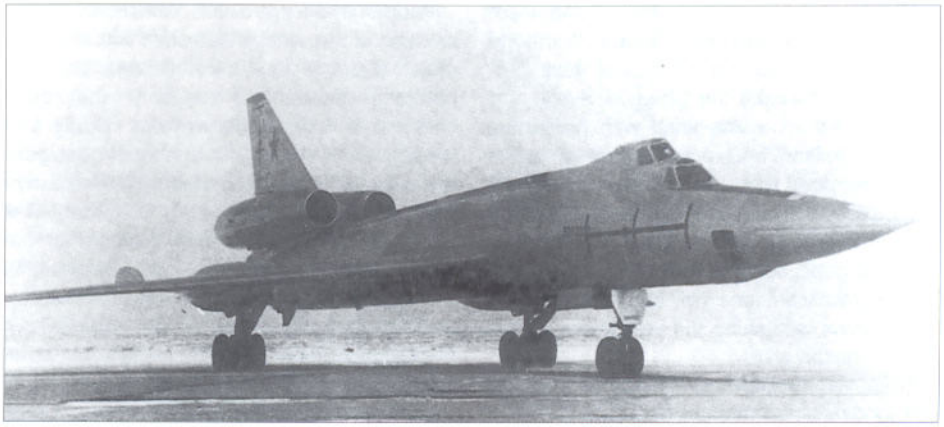
the missile armament were also made to the power supply and air conditioning systems.

After a massive design effort by all three bureaux and co-ordination of the work between them, the joint proposal (advanced development project) was drawn up in early 1960 and received formal approval in March. In May 1960 the Air Force inspected a full-scale mock-up of the Tu-22K and signed an act of acceptance, giving the go-ahead to build the real thing.

Construction of the first prototype had actually begun in late 1959. Two prototypes – 'Red 24' (f/n 604) and 'Red 25' (f/n 605) – were completed in 1960 but required many modifications before they could be handed over for joint acceptance trials (aircraft and missile) in 1961.

Kh-22 Basic Specification

Range:		
– to single targets (eg, a warship)	400 - 500km	248 - 310sm
– to large area targets (eg, a base)	500 - 600km	310 - 372sm
Cruising speed	2,700 - 3,000km/h	1,677 - 1,864mph
Cruising altitude	20,000 - 22,000m	65,616 - 72,178ft
Launch gross weight	4,200 - 4,500kg	9,259 - 9,920lb
Warhead weight	950 - 1,000kg	2,094 - 2,204lb



'Red 24' entered flight test on 1st July 1961. Eight days later, on 9th July, it led the ten-ship formation of Tu-22s during the type's first public appearance at the annual Tushino airshow, the big semi-recessed missile plainly visible. What was not immediately apparent was that the bright red 'missile' was a dummy. It was not until 1962 that prototype Kh-22 missiles were built by plant No.256 in Doobna near Moscow. After the Tushino flypast the Tu-22K received the reporting name 'Blinder-B'.

During the flypast the prototype sported a fairing ahead of the cockpit which clearly indicated that a refuelling probe was due to be fitted. The Tu-22K did not receive this capability until full-scale production began in 1965.

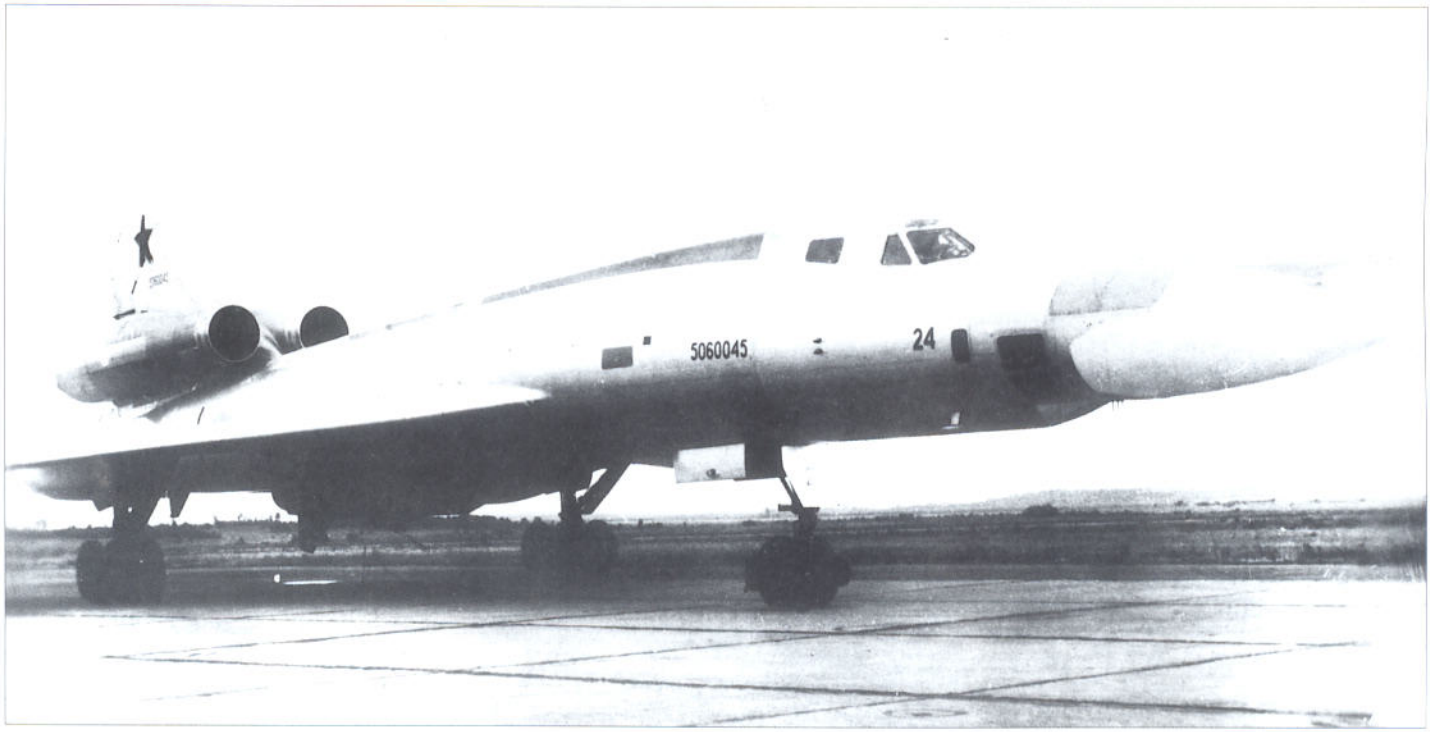
Work on the missile's guidance system proceeded in parallel, and a prototype of the system was put through its paces in 1962. For this purpose KB-1 used a Tu-16 'Badger' bomber converted by the Tupolev OKB to an avionics test-bed and designated Tu-16K-22.

The trials programme of the K-22 weapons system was beset by numerous problems because this was the first Soviet weapons system featuring a supersonic carrier aircraft and a Mach 3 air-to-surface missile with a range of 400 to 500km (248 to 310sm). The K-22 programme demanded a massive research effort to devise new techniques of hitting maritime and land targets in any kind of weather. To accomplish this, the Soviet electronics industry had to switch from vacuum tubes to semiconductors. This improved performance vastly but the development programme dragged on into the late 1960s and was not completed until production of the Tu-22 had almost ended.

The guidance system built around the PN radar was one of the chief sources of annoyance during testing. First, the fuselage nose had to be redesigned and the avionics relocated; then reliability problems set in. Early test flights of the first prototype ('Red 24') showed that the radar set, aircraft-to-missile command link equipment and the guidance unit of the missile itself were extremely sensitive to vibration. The vibration dampers they were mounted on promptly failed and the delicate electronics shook themselves to pieces, needing repairs after every single flight.

Top: **The prototype Tu-22U crew trainer. Note camera calibration marks on the forward fuselage.** Tupolev OKB archive

Below: **One of the first Tu-22K missile strike aircraft during tests to integrate both aircraft and weapon system.** Tupolev OKB archive



Flights were suspended and the engineers set to work designing new dampers. Someone suggested conducting a special test programme to measure the vibration levels, and the first prototype was fitted with numerous vibration sensors and recording equipment. It soon transpired that during take-off and landing the airframe was subjected to low frequency (2 to 20Hz). vibrations. The Lord dampers were no good against them; instead of suppressing the vibrations they amplified them up to 4.5 times, smashing the equipment to bits against the bay walls.

Moreover, measurements made during take-offs, landings, acceleration, deceleration and in flight with flaps and gear down and open missile bay doors showed that vibration levels in the forward avionics bay (frames Nos.4 through 8) and in the missile bay/pylon were well below the limits specified by the manufacturer of the avionics. Therefore, all parties involved in the K-22 programme decided not to mess around with dampers and install the avionics rigidly. The Tu-22K's service record proved this unusual decision to be a good one.

Microwave sensors were used for acquisition and tracking of stationary and moving targets in any weather. New theories of long range radar acquisition were developed. Getting an acceptable signal/noise ratio, improving resistance to ground clutter and active/passive ECM and maximising acquisition range were the main problems facing the designers. Tests showed that the guidance system ensured acquisition and accurate targeting. The resolution of the PN radar and its resistance to clutter were improved in the course of tests and modifications.

Yet, early test launches of the Kh-22 against battleship-sized targets fitted with angle reflectors gave disappointing results. The missile was not manoeuvrable enough and kept straying off course as it dived onto the target. The best engineers from all three bureaux involved in the programme, including academicians A N Tupolev, A A Raspletin (at the head of the radar design team) and Artyom Ivanovich Mikoyan, joined efforts to cure the problem. Within a short time, changes were made to the missile's control system and tested successfully on the second experimental batch. Accuracy was improved dramatically and the VVS specifications were met.

A curious feature of the Kh-22's guidance system making it one of the most effective in the world at the time was that the missile locked on to the target while still suspended under the aircraft. Normally the target was designated by the aircraft's PN radar but, as a backup in case it failed, the Kh-22's own radar (designated PG) could be used for active homing to guide the missile all the way in. This apparent duplication increased kill probability. (Thus, the two radars formed a common system, the second letter indicating where the component was installed. N for noseetel' – carrier [aircraft] while G denoted golovka [samonavedeniya] – literally 'autotracker head', ie, guidance unit.)

People who contributed immensely to the creation of this weapons system which gave a major boost to the Soviet Union's strategic potential included D S Markov (Tu-22 project chief); B V Kulikov (Bereznyak's deputy and Kh-22 project chief); V M Shabanov (designer of the missile's control system); V A Podlesnyy (deputy chief designer of the PG radar); R V Gordeyevskiy (deputy chief designer of the SARH version's guidance unit with the PSI pulse-Doppler radar, S for snaryad – missile); the staff of the 'Almaz' (diamond) OKB responsible for the PN radar and people working in many other research organisations and factories involved in the programme.

Reliability problems with the missile's guidance system, as well as the major modifications Tupolev had to make to the 'Blinder's' control system, caused the Tu-22K test programme to drag on for five or six years and production entry to be delayed accordingly. Only two 'Ks (f/ns 1204 and 1205) were built in 1961 and 1962, none at all in 1963. Two more (f/ns 3003 and 3004) were delivered in 1964 for development of the K-22P air defence suppression version of the weapons system. The missile strike version finally entered full production in 1965 as the probe-equipped Tu-22KD (which see). A total of 76, including 72 Tu-22KDs, had been built when production ended in early 1969.

The Tu-22K attained IOC with the strategic bomber arm of the VVS in 1965. Trials and revisions continued in service. This caused a paradoxical situation: dozens of crews were flying aircraft which officially were not on the VVS inventory! Indeed, the Tu-22K was not cleared for service until 1968 because its high-tech equipment had a very low mean time between failures (MTBF), sometimes leading to fatal crashes, and needed constant modifications to get it up to scratch. The missile also had its share of bugs, the K-22 becoming fully operational only in February 1971.

The K-22 weapons system was designed to destroy ground targets with a high radar signature, large area ground targets and stationary or moving maritime targets at sea or near the coastline. In a typical mission against a large target, a single Tu-22K or several aircraft carrying SARH missiles fitted with the PSI Doppler radar would head towards the target area. During approach the missile's avionics were kept at a comfortable temperature by the Tu-22's air conditioning system and the guidance unit was powered by the aircraft's generators to keep it on ready alert.

The target was acquired by the aircraft's radar at about 500km (310sm) and its co-ordinates were downloaded to the missile's guidance unit. The Kh-22's systems then switched to its own battery, the missile was lowered clear of the aircraft and dropped and its liquid-propellant rocket fired at a safe distance from the aircraft. The Tu-22K made a U-turn at about 430 to 480km (267 to 298sm) from the target and headed for home while the missile accelerated to 3,000 to 3,600km/h (1,864 to 2,236mph) and closed in on the target, cruising at 20,000 to 22,500m (65,616 to 73,818ft) then entering a steep dive at the terminal guidance phase.

If the objective was a small-sized target with a high radar signature, a missile equipped with a PG radar would be carried. In this case the aircraft's PN radar acquired the target at 300 to 350km (186 to 217sm) and illuminated it for the missile. If the aircraft's radar was unserviceable the missile would acquire the target and lock on to it using its own radar. After lock-on the missile was launched, homing in by radar, and the aircraft turned back some 280 to 320km (173 to 198sm) from the target.

If the Tu-22K cruised in subsonic mode (950 to 1,000km/h or 590 to 621mph), combat radius was about 2,500 to 2,750km/h (1,553 to 1,708sm); in supersonic cruise (1,200km/h or 745mph) it was 1,360km (845sm). With RD-7M-2 engines the Tu-22K had a top speed of 1,540 to 1,550km/h (956 to 963mph).

The aircraft could be easily converted for the bomber role by removing the BD-294F missile pylon and fitting standard Tu-22A/Tu-22R bomb racks. The inward-opening missile bay doors peculiar to the Tu-22K would have to be replaced with standard outward-opening doors. The OPB-TsNVU-PN navigation/bomb-aiming system enabled the so-configured Tu-22K to drop bombs in horizontal flight in VFR and IFR conditions, day and night, at up to Mach 1.4. Targets that could be discovered visually and by radar could be bombed from between 2,000m (6,561ft) and 13,500m (44,291ft) flight levels; for targets with a low radar cross section, the altitude range was 10,000m (32,808ft) to 13,500m.

The OPB-TsNVU-PN navigation and bomb-aiming system comprised the OPB-15 optical bomb sight, TsNVU-B-1B (Tsentrahl'noye Navigatseeonnoye Vychisleetelínoye Oostroystvo) central navigational computer, PN radar, the AP-7MTs autopilot, a bombing computer and the bomb racks.

Kh-22 (AS-4 'Kitchen')

The Kh-22 was a supersonic air-to-surface stand-off missile with low aspect ratio, highly swept delta wings and a cruciform tail unit. The lower vertical fin was folded for ground handling and carriage by the aircraft, deploying after launch. The airframe was designed to withstand considerable kinetic heating at high Mach numbers.

The powerplant consisted of an S5.33 (or R201-300) twin-chamber liquid propellant rocket motor which was virtually two motors (booster and sustainer) in one. The engine used TG-02 fuel and AK-20K oxidiser. Both chambers were fed by turbopumps, had separate hydraulic systems for thrust and mixture control, separate pyrotechnic ignition and shut-down mechanisms but shared common fuel and oxidiser supply lines. Both chambers fired simultaneously during launch and the booster chamber was shut down later, the timing depending on the flight mode.

The Kh-22 had two versions for attacking small targets with a high radar signature (such as large ships) and large area targets (carrier groups, convoys, large ground targets etc) respectively. The former version featured a PG radar for active radar homing which locked onto the target when the missile was still suspended under the aircraft. The latter version was equipped with a self-contained navigation unit featuring a Doppler radar, a computer and a gyro. For stabilisation, following the preset course and pitch and roll control the Kh-22 was fitted with an APK-22A autopilot with a hydraulic actuator. Power came from chemical batteries, with an electromechanical converter providing alternating current for equipment. Hydraulic power was provided by an electric pump.

In the active radar homing version the Kh-22 could carry a conventional warhead (the so-called 'Charge N') or a nuclear one ('Charge M'); only the nuclear warhead was fitted to the SARH version.

After launch the missile climbed to cruise altitude and accelerated to cruising speed. In cruise flight it was stabilised by the autopilot featuring an automatic altitude correction mechanism. Heading was determined by the guidance system. The PG version of the active homing radar tracked the target in the vertical and horizontal planes, providing inputs to the autopilot. When the radar scanner's vertical deflection reached a preset limit the autopilot put the missile into a 30° dive, the radar providing control inputs for terminal guidance. The conventional warhead detonated on impact, while the nuclear charge had a proximity fuse.

In the SARH version, the carrier aircraft spotted the target, using the PN radar. Target position data were then downloaded to the missile's computer. After launch the PSI Doppler radar continuously determined the true speed which was processed by the computer to calculate the distance covered by the missile; this was then compared with the preset target range. At a preset distance from the target the autopilot initiated the final dive.

The Kh-22's range to large area targets depended on the Tu-22K's speed and flight level at the moment of launch, as given in the table. When used against large area targets the Kh-22 had a 5km (3.1sm) accuracy margin.

Like its carrier aircraft, the missile was progressively improved and upgraded. New rocket motors with increasing thrust were installed (S5.33A, S5.44, S5.83 and finally S5.83M), the accuracy and MTBF of the guidance system were improved. Late production Kh-22s were much more reliable than early examples. Kh-22 logically evolved into the Kh-22M forming part of the K-22M weapons system described later.

Tests showed that, even with a conventional warhead, the Kh-22 was a deadly weapon against surface ships. A direct hit of a Kh-22 could tear a gaping 20m² (215ft²) hole in the side of a ship and the 900kg (1,984lb) shaped charge warhead could burn its way up to 12m (39ft) into it, incinerating whatever was inside.

Tu-22P, Tu-22P-1, Tu-22P-2 ECM Aircraft 'Aircraft YuP'/'Aircraft AP'

The prototypes of the Tu-22P communications jamming aircraft (it should have been designated Tu-22PP for Postanovschchik Pomekh – ECM aircraft) rolled off the assembly line in 1960. Given the reporting name 'Blinder-E' by NATO's ASCC, this version was to provide ECM cover for formations of VVS and AV-MF strike aircraft.

The mission avionics were mounted in the bomb bay on quick-change pallets; five different configurations were possible. Both active and passive jamming gear was carried. Sometimes the tail gun barbette was replaced by an SSEP with a 'Siren' ECM pack to augment the standard equipment. In due time, however, as ECM equipment grew lighter and more compact, it became a standard fit on strike and reconnaissance aircraft, rendering the Tu-22P unnecessary.

A little over 30 ECM-configured Tu-22s were built as such, in two sub-types differing in equipment fit; these were designated Tu-22P-1 and Tu-22P-2. The other Tu-22Ps (which bore no additional suffixes) were converted from other versions.

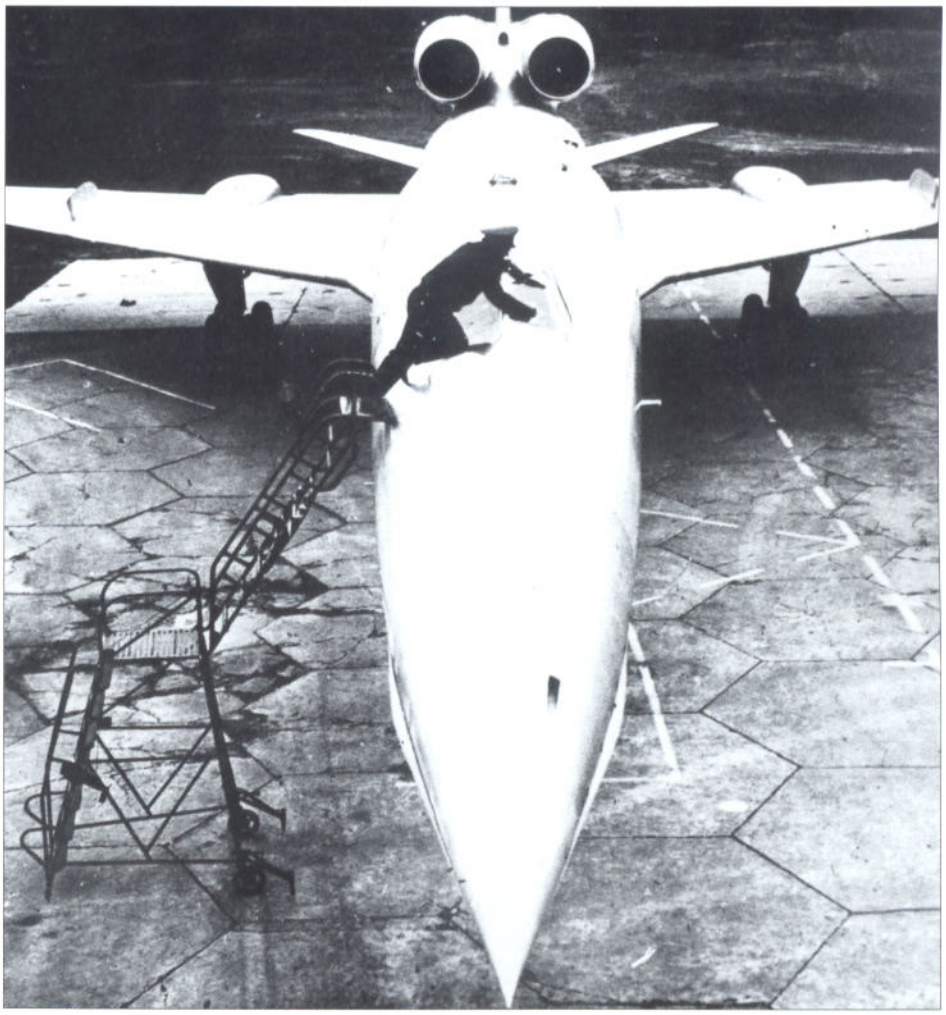
Production Kh-22 Basic Specification

Length	11.65m	38 ft 2.6in
Wing span	3.0m	9 ft 10in
Wing sweep	75° 35'	
Gross weight	5,635 - 5,770kg	12,422 - 12,770lb
Warhead weight	900kg	1,984lb
Fuel load	3,000 litres	660 Imp gallons
Range	300 - 500km	186 - 310sm
Cruising speed	3,000 - 3,600km/h	1,864 - 2,236mph
Cruise altitude	22,500m	73,818ft
Launch altitude	10,000 - 14,000m	32,808 - 45,931ft

Kh-22 Range in varying Tu-22K Flight Envelopes

Speed	950km/h	590mph
	1,400km/h	869mph
	1,720km/h	1,068mph
Flight level	10,000m	32,808ft
	12,000m	39,370ft
	14,000m	45,931ft
Range	400km	248sm
	500km	310sm
	550km	341sm

Forward view of a Tu-22R reconnaissance aircraft. Yefim Gordon archive



'Blinder' Production and Updates

Despite considerable difficulties encountered with the Tu-22, Kazan was getting ready for production. The Tu-22R recce version, Tu-22U trainer, Tu-22K missile carrier and Tu-22P ECM aircraft all entered limited production in 1960, and the tempo gradually increased.

In the summer of 1961 the Soviet leaders decided to unveil the Tu-22 at the Tushino airshow. Western military attachés were very impressed when, on 9th July, nine initial production Tu-22As and Tu-22Rs then undergoing tests streaked over Tushino with an almighty howl. The three groups of three aircraft were led by the Tu-22K prototype piloted by N N Kharitonov. The announcer proudly declared that these aircraft were 'capable of exceeding the speed of sound by far'. Little did the spectators know how much blood, sweat and tears (sometimes literally) those glorious moments over Tushino had cost.

A total of 311 'Blinders' of all versions had been built when production ended in December 1969. The production list is detailed below. Tu-22s have seven-digit construction numbers (c/n) using the coding system introduced in 1960. They are usually quoted in abbreviated form (batch number plus number of aircraft in batch); this can be regarded as the fuselage number. For example, the c/n of the Tu-22A on display in Monino is 5050051, which corresponds to f/n 505 (Batch No.5, fifth aircraft in batch). The fourth digit of the full c/n denotes the year of manufacture (0 = 1960). On early production aircraft the c/n was sometimes stencilled on the tail.

A total of 64 batches was built. Batch No.1 contained two aircraft, Batch No.2 had three and the final batch just a single aircraft; most, however, had five aircraft to a batch. Batches Nos.1 through 6 were a mixed bag, featuring all models; batches Nos.7 through 31 consisted almost entirely of Tu-22Rs. Mixed production resumed with Batch No.29, though those in batches No.29 to 61 were mostly 'KDs. Batches Nos.62 to 64 were Tu-22U trainers, except f/n 6201 which was the last Tu-22KD. After that, plant No.22 launched production of the 'Blinder's' successor, the Tu-22M (an entirely different aircraft, described separately).

Starting from Batch No.30, all production 'Blinders' were equipped with a PT-1 (Preeyomnik Topliva – fuel receptacle) nose-mounted telescopic refuelling probe for the hose-and-drogue system. This resulted in the suffix letter 'D (for Dahl'niy – long range) being added to the designation, eg, Tu-22RD.

The Tu-22 received numerous upgrades during its production and service career which improved its performance and maintainability a good deal. One problem encountered at an early stage was aileron reversal at high Mach numbers caused by inadequate rigidity of the high aspect ratio wings; this even caused the VVS to impose a Mach 1.4 cruising speed limit for a time.

To fix the problem, Tupolev developed 'flap/ailerons'; these were not exactly flaperons in the traditional sense because the Tu-22 had

Tu-22 'Blinder' Production

	1959	1960	1961-2	1963	1964	1965	1966	1967	1968	1969	Total
Tu-22A	5	10	–	–	–	–	–	–	–	–	15
Tu-22R/RD	–	3	28	33	37	11	5	10	–	–	127
Tu-22K/Kd	–	2	2	–	2	10	20	20	16	4	76
Tu-22P/PD	–	2	1	–	5	9	10	10	9	1	47
Tu-22U/UD	–	3	2	3	5	5	5	10	2	11	46

View of an operational Tu-22KD ramp. Nearest the camera is 'Red 18'. Yefim Gordon archive

conventional ailerons as well. The 'flap/ailerons' worked as flaps in subsonic flight; the 'true' ailerons were locked neutral automatically at transonic or supersonic speed and the flaps took over for roll control. This feature was introduced in 1965 and aircraft built earlier were progressively retrofitted.

The VD-7M turbojet was notoriously unreliable; besides, the VVS pushed the manufacturer to increase thrust, especially take-off thrust. Meeting the demand, RKBM (alias Rybinsk OKB-36) came up with a much-improved version designated RD-7M2 which entered production in 1965. About 120 new-build Tu-22s were powered by this engine rated at 107.8kN (24,250lb st) dry and 161.7kN (36,375lb st) reheat; the augmented thrust allowed TOW to be increased to 92,000kg (202,821lb).

Installing the new engines necessitated modifications to the nacelles. Engine accessories changed as well; eg, the VD-7M was started electrically, whereas the RD-7M2 had a jet fuel starter. The update increased the top speed to 1,600km/h (994mph)/Mach 1.7 and improved reliability. By the early 1980s, most early production Tu-22Rs and 'RDs, Tu-22Ks and 'KDs and Tu-22Ps and 'PDs had been retrofitted with RD-7M2 turbojets. Nearly all 'Us and 'UDs had the new engines from the start. Comparative performance figures of the Tu-22 with the new and the old engines are given in the table.

'Blinder' Engine Comparisons

Powerplant	2 x VD-7M	2 x RD-7M2
Performance	(test data)	(estimated)
Engine thrust in full afterburner		
	2 x 156.9kN	2 x 161.7kN
	2 x 35,273lb st	2 x 36,375lb st
Top speed	1,500 - 1,600km/h	1,700km/h
	932 - 994mph	1,056mph
Supersonic cruise	1,250 - 1,350km/h	1,500km/h
	776 - 838mph	932mph
Range		
– supersonic cruise	1,950 - 2,000km	2,100 - 2,150km
	1,211 - 1,242sm	1,304 - 1,335sm
– subsonic cruise	5,500km	5,800km
	3,417sm	3,604sm
Service ceiling above target		
	14,500m	15,000m
	47,572ft	49,212ft
Take-off run	2,500m	2,400m
	8,202ft	7,874ft

Much development work was invested to give the 'Blinder' flight refuelling (IFR) capability. Tupolev chose the hose-and-drogue system so that they could work with Tu-16N 'Badger-A' and Myasischchev 3MS-2 'Bison-B' single-point tankers. The latter shared bases with the Tu-22s, allowing a greater portion of their fuel to be transferred to the receivers. The system became operational on Tu-22s in 1965; as mentioned earlier, probe-equipped 'Blinders' received an additional 'D suffix letter. A total of 176 probe-equipped Tu-22s was built. This included recce aircraft (31 out of 127), missile carriers (72 out of 76), ECM aircraft (40 out of 47) and trainers (33 out of 46).

Almost simultaneously (in 1964), single-point pressure refuelling was introduced - for the first time in the USSR. Ground refuelling via numerous gravity fillers was an excessively time-consuming and complicated procedure, considering that the Tu-22's fuel load exceeded 40 tons (88,183lbs). Besides, single-point refuelling reduced fire risk.

Range was 7,200km (4,473sm) with one IFR top-up, 8,000km (4,971sm) with two top-ups *en route* to the target or 8,500km (5,281sm) with one top-up on the outbound leg and another on the return trip. Refuelling was possible at up to 600km/h (372mph) IAS and 8,000m (26,246ft). The refuelling system had a fuel transfer rate of 1,600 to 1,800 litre/minute (352 to 396 Imp gallon/minute); a total of 15,800kg (34,832lb) of fuel could be transferred in a single session.

The Tu-22 lost its flight refuelling capability at the end of its career in the late 1980s. Most aircraft had their refuelling probes removed to limit range and put them outside the strategic aircraft category pursuant to the SALT-2 (Strategic Arms Limitation Treaty) arms reduction treaty. Besides, most of the Tu-16N and 3MS-2 tankers had by then been withdrawn from use as time-expired.

Other improvements introduced in service included standardised electrical, hydraulic and pneumatic connectors, as well as features reducing the aircraft's dependence on ground equipment.

The control system proved to be particularly difficult because Tupolev was breaking much new ground with it, having no previous experience with irreversible hydraulic actuators on heavy aircraft. The wide speed range required pitch and roll dampers to be installed because the pitch/roll force ratio changed as the aircraft slipped through the sound barrier. Thus, the artificial-feel unit was augmented first by a duplex pitch damper and then, in 1966, by a triplex one. Shortly before production ended a duplex dry friction damper was introduced to neutralise the lag between pilot input and control surface deflection caused by dry friction in the mechanical control runs.

In its early days the Tu-22 was prone to so-called gear-induced flutter because the main gear units were rigidly attached to the wing spars. In flight, the gear units would be aft of the wing torsion box and would bob up and down, twisting the wings and increasing the risk of flutter. The problem was eliminated by attaching the gear via hydraulic dampers and causing it to vibrate out of step with the wings. This increased wing/landing gear flutter speed to 1.5 times the aircraft's never exceed (V_{NE}) speed, allowing the wingtip anti-flutter weights to be deleted.

The 'Etalon' mid-life update (MLU) programme was a major effort which lasted several years, and some VD-7M-powered aircraft with a Mach 1.4 speed limit served on until the early 1980s, waiting their turn.

Despite modifications to the control system, early production aircraft still had a propensity to pitch oscillations. More research showed that the rather flexible wings which had 4° negative camber would twist at high speeds, increasing camber even more. This decreased the angle of attack (AoA) at the tips, causing the lift vector to move forward and decreasing static stability so that the Tu-22 became pitch-neutral.

An automatic balancing device was added to the control system; but there was still room for improvement. In one test flight V P Borisov (project test pilot for the Tu-22 from 1960 to 1968) was to determine whether the stabilator actuators were powerful enough at high speeds. At 1,050km/h IAS (652mph IAS or Mach 0.89) and 4,500m (14,763ft) he was to deflect the stabilators sharply 3° and return them to neutral as fast as possible. During this manoeuvre the aircraft experienced a monstrous g load amounting to 80% of the destructive load.

To prevent such dangerous manoeuvres which could overstress the aircraft, a second artificial feel unit (AFU) was added, increasing stick forces by some 25 to 27kg (55 to 57lb). Initially it operated only in pitch control mode and was triggered by moving the control column past a certain limit. The designers of the AFU believed it need not be activated during turns because control column/wheel movements were much greater than in straight flight. Borisov thought differently and insisted that a check flight be made.

At 880km/h (546mph) IAS Borisov made a sharp turn, rolling the aircraft 60°. This produced a vertical load of 2.8g; to prevent it from getting any bigger the pilot pushed the control column forward and the aircraft immediately pulled negative g (–1.7). Borisov hauled back on the control column, trying to compensate, and got +4g immediately! Realising that the aircraft would break up in a few seconds, he did the only possible thing and held the controls in neutral position. The wild pitching subsided.

This was convincing enough. The AFU was set to stay on throughout the flight envelope. Later experiments and service experience led to the addition of a hydraulic limiter in the pitch channel. Triplex pitch dampers were introduced on production aircraft in 1966 from f/n 4501 onwards, and duplex dry friction dampers followed in 1968 from f/n 5903 onwards.

Another problem associated with the control system surfaced at supersonic speeds. Some portions of the fuselage skin got hotter than others; this caused the fuselage to buckle and the hydraulic actuator control rods to move in their own accord. This resulted in uncommanded control surface deflection which had to be countered by the pilot. Distinguished test pilot (an official Soviet term reflecting experience and qualification) A Ya Nikonov recalled that 'sometimes the aircraft would try so hard to roll that you had to turn the control wheel 90° to compensate for this! You could not fly in these conditions, much less launch missiles!'

The state acceptance trials showed that the AP-7MTs autopilot was unreliable. On 9th September 1966, Tu-22K f/n 3102 piloted by V F

Chernoivanov was lost when the autopilot pitch control channel failed. The aircraft started 'see-sawing' and broke up in mid-air, killing the pilot and gunner/radio operator.

Another aircraft, Tu-22RD f/n 3304 crashed on 22nd April 1967, with the tragic loss of the whole crew (pilot V Korchagin, navigator G Pronin and gunner/radio operator A Sannikov). One of the engines had caught fire due to an uncontained failure of a starter-generator; to make things worse, the fire warning system had also failed.

With no direct view of the engines, the crew was unaware of their predicament until a pilot doing aerobatics in a MiG-15 'Fagot' some way off radioed to the pilot: 'You're on fire!'. Korchagin called ground control, requesting assistance; air traffic (ATC) told him to make a low pass over the tower so that they could see for themselves. This proved fatal. On seeing the smoke the air traffic gave orders to climb to 2,000m (6,561ft) and eject, but apparently the fire had burned through the control runs and the aircraft dived into the ground when Korchagin attempted to climb.

The test pilots and ground crews at the NII VVS test centre in Akhtoobinsk in southern Russia (near Astrakhan' at the mouth of the Volga river) contributed immensely to the testing and improvement of the Tu-22. Up to three 'Blinders' were stationed at Akhtoobinsk at any one time during the early 1960s. Test work was performed mainly by the crews of S L Timonin, Yuri M Sookhov (who later became a full-time test pilot with Tupolev and flew the Tu-154 'Careless' trijet airliner on its maiden flight) and V I Kuznetsov; the latter was awarded the Hero of the Soviet Union (HSU) title on 21st October 1965 for performing the Tu-22's high-alpha (high AoA) trials. Other military test pilots and specialists involved in the Tu-22 programme included Yuri M Tarasov, E V Golenkin, N K Poletayev, V A Mezentsev, V P Petrikov, Yuri A Novikov, V D Maznyov, A I Moiseyev, I I Argastsev and D G Demenko.

As mentioned earlier, the lengthy tests and perpetual modifications resulted in a curious situation: the Kazan factory was busy producing and the VVS operating an aircraft which was not officially cleared for service. Eight major modification programmes were undertaken between 1959 and late 1968 when the Tu-22R, Tu-22K, Tu-22P and Tu-22U officially joined the VVS inventory; however, work on the K-22 weapons system continued and the system became fully operational in 1970.

By then the massive efforts of the OKB, the VVS and the Ministry of Aircraft Industry had finally come to fruition: the 'Blinder's' control system problems were cured and the aircraft could be flown safely by service pilots. Former NII VVS test pilot A Ya Nikonov, who became a factory test pilot in Kazan and checked out the final batches, had a lot to say in praise of the latest Tu-22s with the improved control system. He certainly knew what he was talking about – over the years he had logged 374 hours in 192 flights on the type.

Upgraded Tu-22s are described below.

Tu-22RD Long Range Recce Aircraft 'Aircraft AD'

This was the Tu-22R Photint/Elint aircraft equipped with a refuelling probe. The first two 'RDs (f/ns 801 and 901) were converted from standard 'Rs in 1962; new-production 'RDs started rolling off the production line three years later.

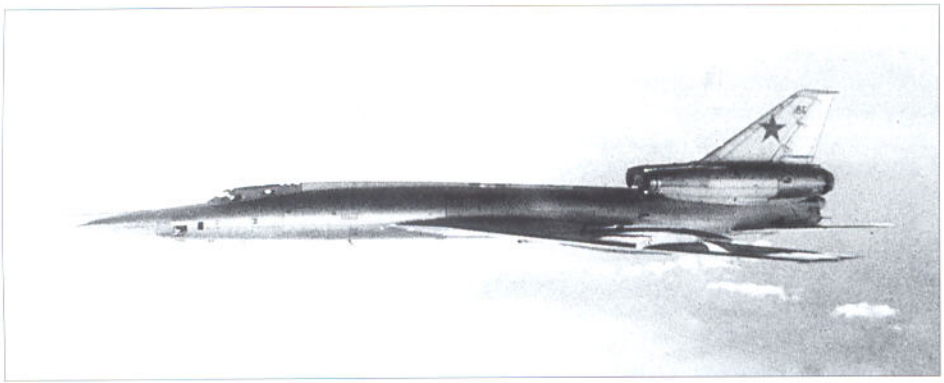
Two Tu-22RDs (f/ns 5404 and 5405) were fitted with the SPS-100 'Rezeda' ECM pack (pronounced 'rezedah' – mignonette, a greenish white Mediterranean flower) in an 'standard strap-on ECM pod' (SSEP) supplanting the tail gun barbette, as on earlier 'Siren I'-equipped aircraft. The 'Rezeda' installation was identical to that of the Tu-16Ye 'Badger-L' Elint aircraft (sometimes misidentified as one of the numerous versions of the Tu-16R). The two aircraft underwent comprehensive tests, but no other Tu-22RDs were similarly converted.

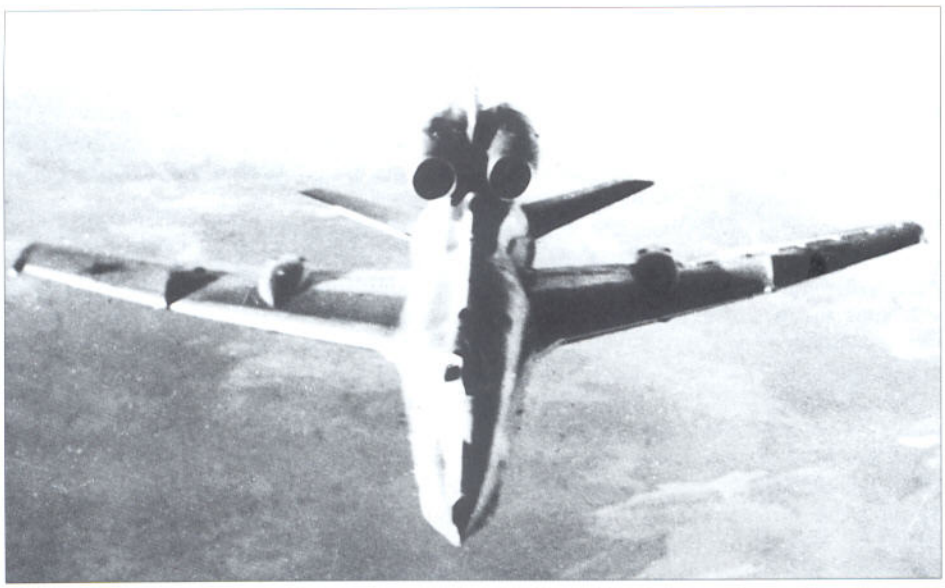
Tu-22R and 'RD with RD-7M2s, Specification

Maximum take-off weight		
	91,000 - 92,000kg	200,617 - 202,821lb
Empty weight		
Tu-22R	47,830kg	105,445lb
Tu-22RD	48,000kg	105,820lb
– with 'Rezeda I' ECM pack		
	47,930 - 48,100kg	105,665 - 106,040lb
Top speed	at 11,000m	36,089ft
	1,550km/h	963mph
Effective range		
– in subsonic cruise, 5% fuel reserves		
	4,800km	298sm
– with one top-up	6,400km	3,976sm
– supersonic cruise	1,750km	1,087sm
– hi-lo-hi 1,000km/621sm supersonic		
	2,110km	1,311sm
Service ceiling	13,500m	44,291ft
Take-off run		
– without JATO	2,250m	7,381ft
– with JATO	1,600m	5,249ft
Landing run	at 53,000kg	116,843lb
	1,250m	4,101ft

Tu-22RK and Tu-22RDK Long Range Recce aircraft 'Aircraft ARK'/'Aircraft ARDK'

In 1967 a production Tu-22RD (f/n 4702) was retrofitted with an SRS-11 'Koob-4' (Cube) detailed Sigint pack in Kazan. This version was recognisable by additional aerials in teardrop fairings on both sides of the forward fuselage and in the wing roots. After the test programme was completed in March 1975, in the late 1970s a number of Tu-22Rs and 'RDs were converted to this standard and redesignated Tu-22RK and Tu-22RDK respectively (K for 'Koob').





Two views of Tu-22RDs in flight.
Both Yefim Gordon archive

Tu-22RM Long Range Recce Aircraft 'Aircraft ARM'

In June 1967 a standard Tu-22R (f/n 2003) was fitted with a new Elint suite in Kazan and tested as the Tu-22RM (Modifitseerovannyy – modified). However, the aircraft remained a one-off because the cameras it carried were outdated and the new equipment, including an infra-red (IR) imager, was not performing as it should. The sole Tu-22RM was delivered to the 199th ODRAP (Independent Long Range Recce Regiment) based at Nezhin.

Tu-22RDM Long Range Recce Aircraft 'Aircraft ARDM'

A mid-life update (MLU) programme was developed for the Tu-22RD in the late 1970s. The new equipment package included state-of-the-art high resolution cameras (eg, the AP-402), an enhanced thermal imaging system etc. The equipment was carried in a special air-conditioned bay because the high resolution could only be obtained at certain temperatures.

Conversion of Tu-22RDs to Tu-22RDM standard, as the new version was called, began in 1981. However, the first aircraft to be converted was actually an early-model Tu-22R (f/n 0905), not a Tu-22RD.

As with the Tu-22RM, the main distinguishing feature was a ventral canoe fairing over the recce equipment. A total of eleven aircraft was converted; all of them went to the 290th ODRAP at Zyabrovka air base and the naval recce regiment at Saki airbase in the Crimea (Ukraine).

Tu-22KD Missile Strike Aircraft 'Aircraft AKD'

As the name implies, this was the probe-equipped Tu-22K. But there was more to it; as the Kh-22 missile was upgraded some of the Tu-22KD carrier aircraft were refitted with improved PNN and PMN search and target illumination radars. These had larger radomes but the difference was not very obvious.

Like its precursor, the Tu-22KD could also operate in the bomber role if fitted with Tu-22A standard bomb racks. The arrangement was tested on f/n 4603 at NII VVS in 1973. Accuracy was found to be adequate with the OPB-TsNVU-PN bomb-aiming and navigation system and the Tu-22KD was cleared for use as a bomber as well.

The Tu-22KD equipped the VVS's long range bomber units whose main function was missile attack, with free-fall bombing as a secondary role – very secondary, in fact. The bombing equipment that came with the Tu-22KD was rarely used, if at all.

Starting in the mid-1970s, many Tu-22RDs were retrofitted with the 'Siren I' ECM pack. The first aircraft to be so equipped (f/n 6104) was tested at NII VVS in late 1972.

Tu-22UD Bomber Trainer 'Aircraft AUD'

Logically, probe-equipped Tu-22U crew trainers were designated Tu-22UD.

Tu-22KP and Tu-22KPD Air Defence Suppression Aircraft 'Aircraft AKP'/'Aircraft AKPD'

As far back as in early 1959 the GKAT (Gosoodahrstvennyy Komitet po Aviatseeonnoy Tekhnike. – State Committee for Aviation Hardware) and the VVS raised the issue of developing an anti-radiation missile (ARM) system based on the Kh-22. Thus, on March 10, 1959 the GKAT tasked the Tupolev, Mikoyan and Bereznyak bureaux with adapting the Tu-22K for long range air defence suppression duties – specifically destroying mobile air defence radars. The project was to be submitted within three months.

Preliminary development work began right away but the project was shelved shortly afterwards. The Military Industrial Commission (a government body responsible for the choice of military hardware) decided there was no point in proceeding with a new system until tests of the similar K-11 system had been completed. (For the record, this comprised the subsonic Tu-16K-11-16 'Badger-G' and K-11/AS-5 'Kelt' passive radar homing air-to-surface missile.)

The 'Wild Weasel' Tu-22 project was revived in 1962 when, on 24th August, the Council of Ministers issued a directive, ordering the development of the K-22P weapons system to destroy land based and shipboard radars (P – Passivnoye Samonavedeniye – passive [radar] homing). The system included the Tu-22KP fitted with a 'Koors-N' (Heading) Elint/targeting system and the Kh-22P ARM; this was equipped with a PGP passive radar homing unit (model PG, passive version) and an APK-22A autopilot.

The prototype development work was largely completed by early 1964, and two Tu-22KPD prototypes (f/ns 3002 and 3003) were built in Kazan towards the end of the year. These two probe-equipped aircraft were used in a lengthy test programme. The Tu-22KPD posed quite a few problems; finding the best location for the receiver antenna array of the Elint/targeting system was perhaps the biggest one. The original plan was to fit it to the refuelling probe, with the receiver in the avionics bay aft of the PN radar and a display at the navigator's station. However, it soon turned out that this arrangement was unsatisfactory because the refuelling probe was not rigid enough. On prototypes the antenna array was installed on a small pylon on the starboard side of the forward fuselage.

Originally the Tu-22KPD was to feature an SPS-100A 'Rezeda-A' ECM pack in the aft fuselage. The SPS-100A still was not working properly when the prototypes entered flight test and both aircraft retained the standard defensive armament.

Trials continued well into the 1970s because of troubles with the 'Koors-N'. In 1966 one of the prototypes lost both engines at 11,000m (36,089ft) while flying at top speed and went into a dive. After many unsuccessful attempts test pilot Boris I Veremey managed to relight the engines at low altitude and landed safely.

It was quickly determined that the flameout was caused by turbulence generated by the pylon-mounted antenna array, and a massive research effort followed. Eventually Tupolev and the design bureau responsible for the Elint/targeting system agreed to place the antenna array within the radome, which had to be recontoured to accommodate it.

A small number of Tu-22KDs were converted to Tu-22KPD configuration in the 1970s when all problems associated with the new equipment had been finally fixed. These 'Wild Weasels' stayed in service until the early 1990s.

In a typical mission, the Tu-22KPD would fly solo or as part of a strike group. The navigator would detect an enemy radar on his display at 380 to 350km (236 to 217sm) range and the aircraft would change course, going squarely for the target. Target location data were downloaded to the Kh-22P's control system and the passive homing unit would start tracking the radar. The Tu-22KPD would then launch the missile and head for home while the ARM proceeded to the target like any ordinary Kh-22.

Empty weight was slightly greater than that of the basic aircraft because of the new mission avionics (48,800kg/107,583lb for the Tu-22KPD and 48,430kg/106,768lb for the Tu-22KP without probe).

Combat radius was 2,800km (1,739sm) or 1,300km (807sm) at a cruising speed of 950 to 1,000km/h (590 to 621mph) or 1,200 to 1,300 km/h (745 to 807mph) respectively; maximum range in subsonic cruise with one fuel top-up was 3,600km (2,236sm).

Active and Passive ECM Capability

Tupolev also paid much attention to giving all versions of the Tu-22 active and passive ECM. Various ECM equipment could be installed in the SSEP replacing the tail gun barbette.

Some proposed upgrades never materialised. For example, new palletised Sigint packs were considered for the Tu-22R in 1963, including the SRS-4 'Kvadrat-2' (pronounced 'kvadraht' – square) and the SRS-5 'Vishnya' (cherry). The former was fitted to one of the sub-types of the Tu-16R (probably 'Badger-F'); as on the Tu-16R, the SRS-4 came complete with an operator's cabin in the bomb bay.

Another 'could-have-been' Tu-22R and 'RD upgrade was developed in the early 1970s to meet a 1973 VVS request. The mission avionics suite featured a 'Shompol' (ramrod) side-looking airborne radar (SLAR) and thermal imaging equipment replacing the standard cameras in the bomb bay.

No.1 fuel cell was removed to make room for two AFA-42/100 cameras; another camera was installed in the avionics bay. Yet more cameras could be carried in an external pod. The aircraft was also to be fitted with a new R-807 UHF communications radio, a new SO-69 identification, friend or foe transponder and an SSEP housing SPS-151, SPS-152 or SPS-153 'Siren I' ECM and ASO-2I chaff/flare dispensers. This was not carried through.

Tu-22A (II) Bomber

The Tu-22A designation was sometimes re-used for Tu-22Rs and 'RDs configured to carry free-fall nuclear bombs (ie, fitted with an air conditioning system in the bomb bay and anti-radiation shielding for the crew).

Tu-22RTK Recce Aircraft (Project)

While developing new versions, the Tupolev OKB sought to refine the basic Tu-22. In order to increase the performance of the early VD-7M version Tupolev devised a rewinged recce aircraft designated Tu-22RTK. The wings had a new and thinner airfoil, hence TK for tonkoye krylo - thin wing. However, the thin wings had an adverse effect on field performance. The engineers tried to compensate for this by using blown flaps. Two Kolesov RD36-35 auxiliary turbojets of 22.9kN (5,170lb st) installed in the aft ends of the landing gear fairings provided bleed air for the flaps and additional thrust. Eventually, the project was abandoned.

Tu-22 STOL with Lift-Jets (Project)

The Kolesov RD36-35 turbojet was designed primarily as a lift-jet for VTOL/STOL aircraft. Besides the production Yakovlev Yak-38 (or Yak-36M) 'Forger' shipboard fighter, these included various experimental aircraft, such as the 23-01 'Faithless' (a delta-wing forerunner of the 'true' MiG-23 'Flogger' prototype, or the MiG-23-11); the 23-31 (Izdelye 92) – actually a much-modified MiG-21PFM 'Fishbed-F' obstinately misidentified in the West as the MiG-21PD (Podyomnyye Dveegateli – fitted with lift engines); and the Sukhoi T-58VD (Vertikahlinyye Dveegateli), a converted Su-15 'Flagon-A' interceptor. (For more details of the Yak-38 see *Yakovlev's V/STOL Fighters* by John Fricker and Piotr Butowski and *MiG-21 'Fishbed'* by Yefim Gordon and Bill Gunston for the MiG-21, both in the Aerofax range.)

This engine was actually used on the 'Blinder' as well. By way of experiment, one Tu-22 was fitted with two RD36-35 lift jets in the main gear fairings in an effort to give the bomber STOL capability. The results were not encouraging and the idea was not pursued further.

Tu-22 with NK-144 Engines (Project)

In a final attempt to improve the Tu-22's performance, Tupolev suggested fitting Kuznetsov NK-144 afterburning turbofans developed for the Tu-144 'Charger' supersonic airliner and rated at 196kN (44,091lb st) in full afterburner. The project never materialised, even though the engine was readily available by then.

Tu-22LL Equipment Test-bed

In 1971 a standard Tu-22R ('Red 05', f/n 2005) was converted in Kazan to an equipment test-bed designated Tu-22LL. The suffix denoting Letayuschchaya Laboratoriya (literally flying laboratory); this Russian term is used indiscriminately and can denote either an engine, avionics, equipment or weapons test-bed or a research/survey aircraft, depending on what the aircraft is used for.

The Tu-22LL was initially used by LII to test new night reconnaissance cameras (NA-Ya-7 and NA-Ya-8) coupled with the 'Yavor-8' (sycamore) high power searchlight for target illumination. They were later replaced by various colour and spectrum (IR) photography cameras of the 'Zona' (zone) family capable of discerning targets hidden under camouflage netting etc. Neither of these cameras was fitted to production Tu-22Rs and 'RDs.

Later the Tu-22LL became an avionics test-bed for various targeting and Elint systems. In its final configuration it sported a large triangular aerial under the nose. On 18th August 1991 the Tu-22LL took part in the Aviation Day flypast at Zhukovsky, accompanied by a MiG-21UM 'Mongol-C' acting as chase aircraft. The 'Blinder' appeared to have some trouble taking off for that flight, as the starboard engine's afterburner proved rather reluctant to ignite. The aircraft was retired at Zhukovsky in 1992.

Photograph on this page:

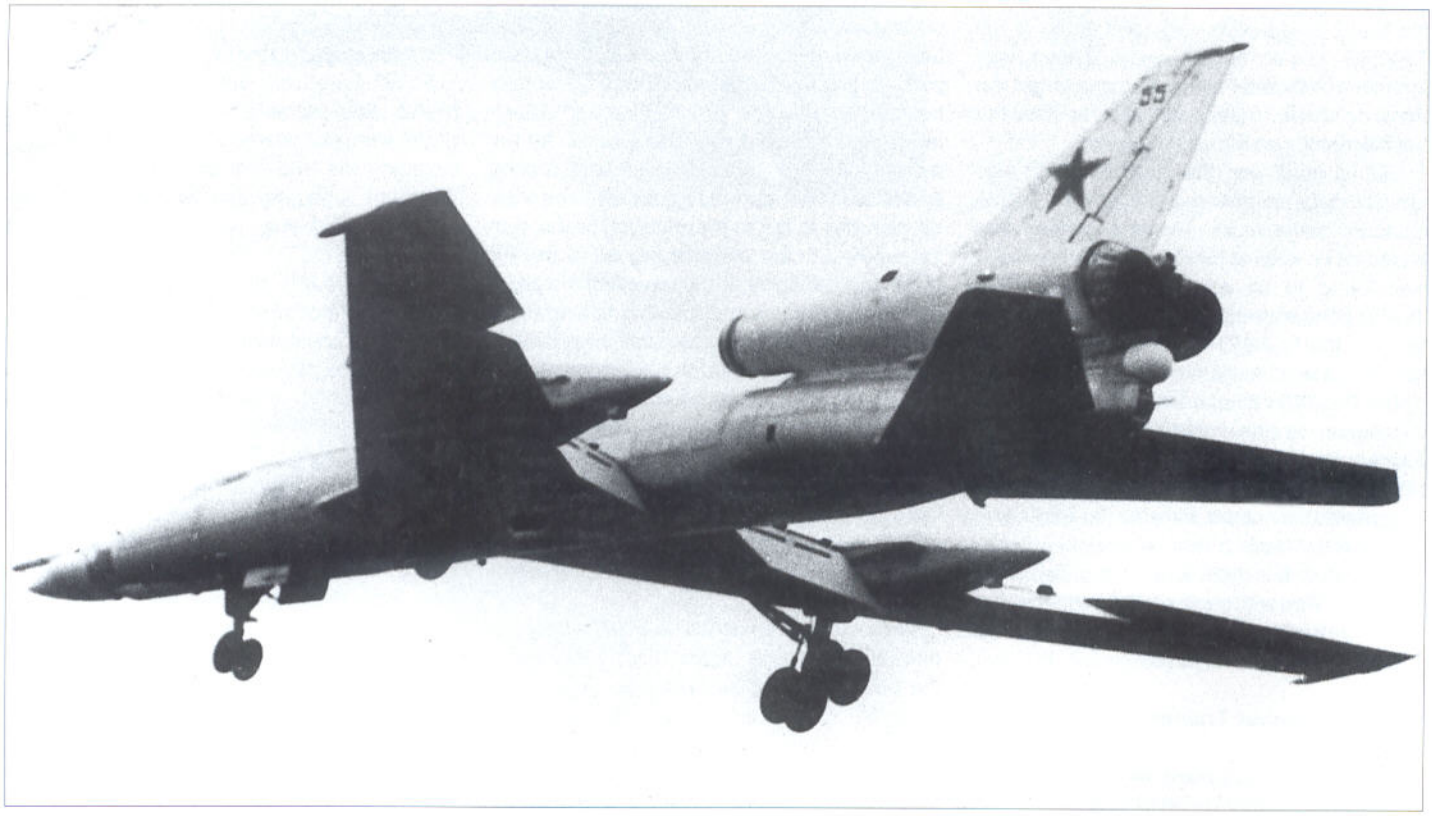
A Tu-22KD on approach to land. The generous flap area is evident. Yefim Gordon archive

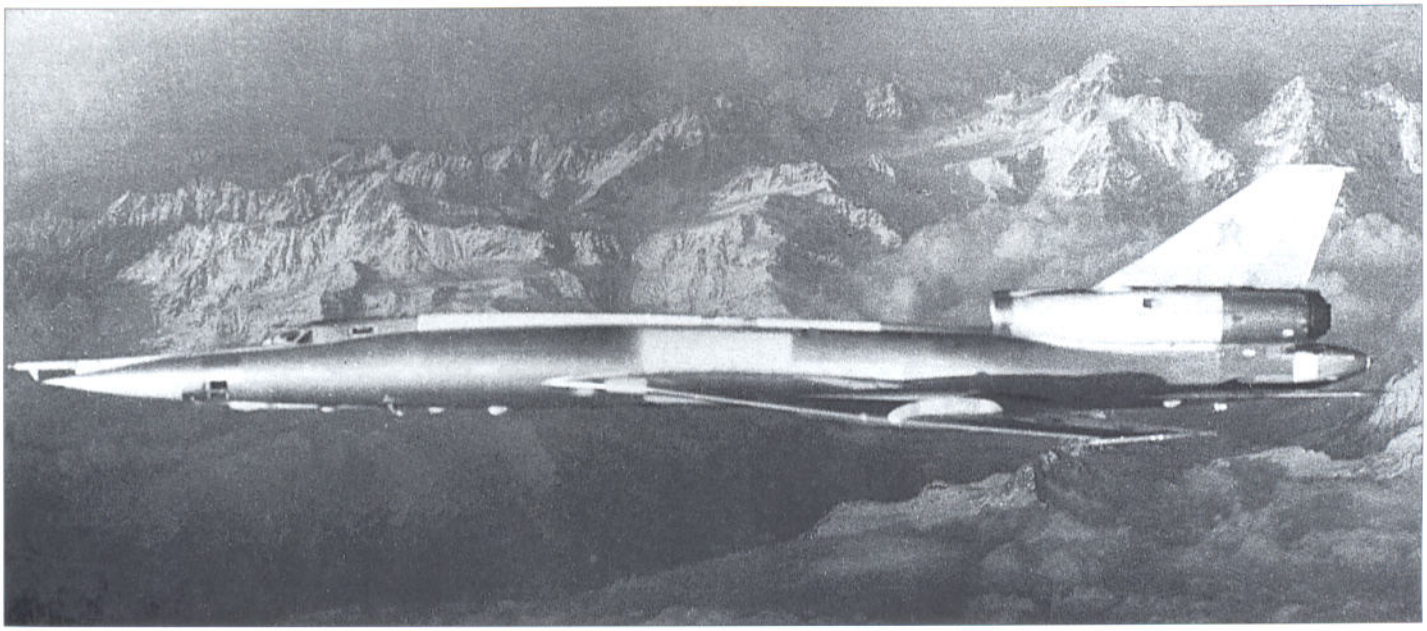
Photographs on the opposite page:

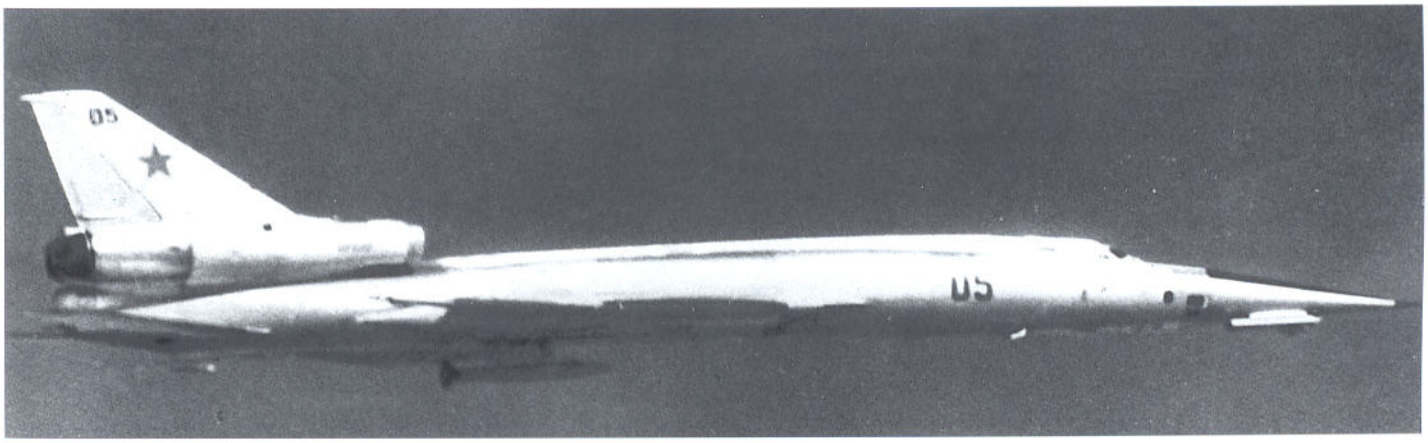
Top: **Early version of the Tu-22PD.**

Centre: **'Red 05' started life as a standard Tu-22R, but was converted at Kazan into the Tu-22LL flying test-bed.**

Bottom: **Shock waves visible in the jet efflux and the main gear tucking up, this Tu-22KD during climb out or go-round.** All Yefim Gordon archive



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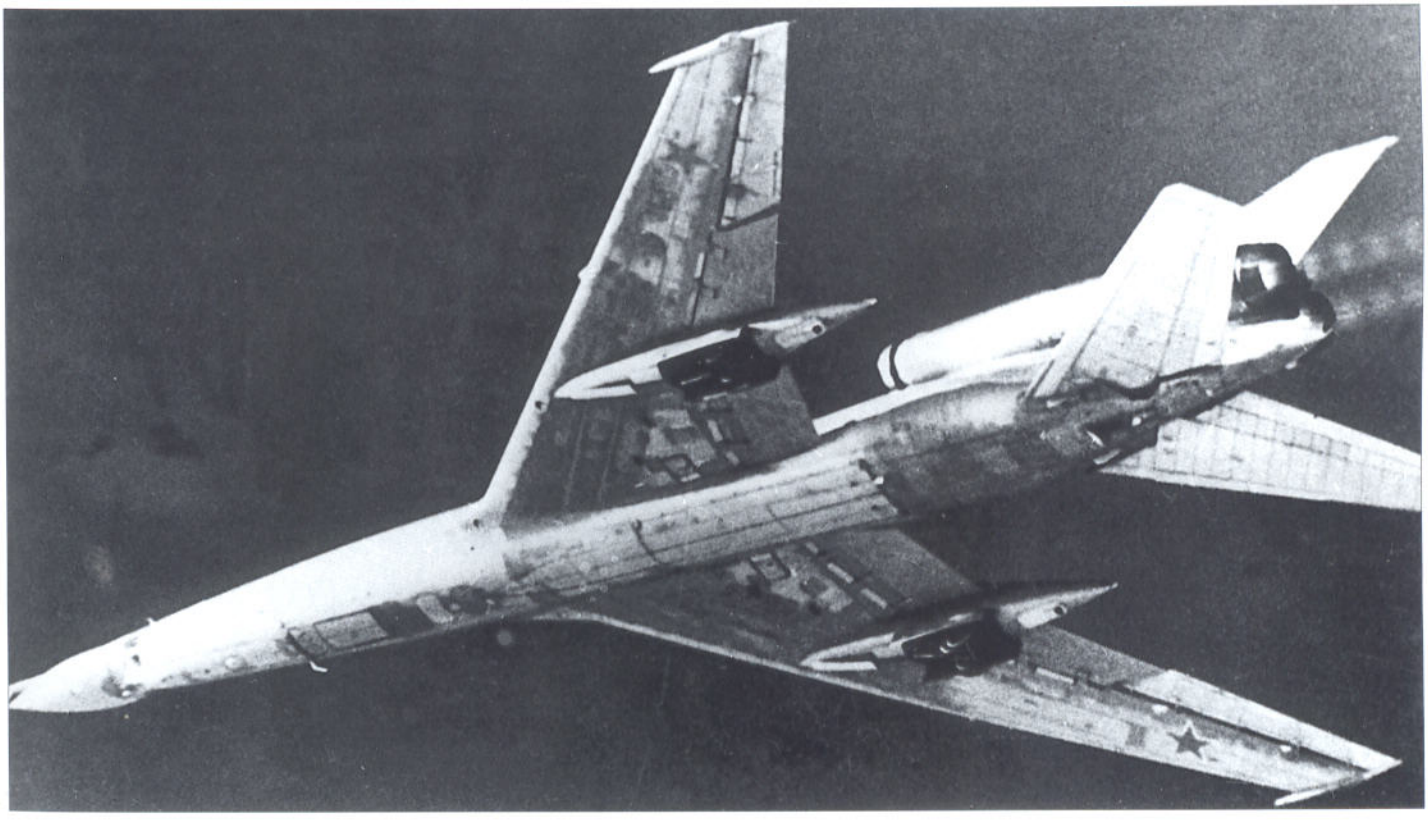
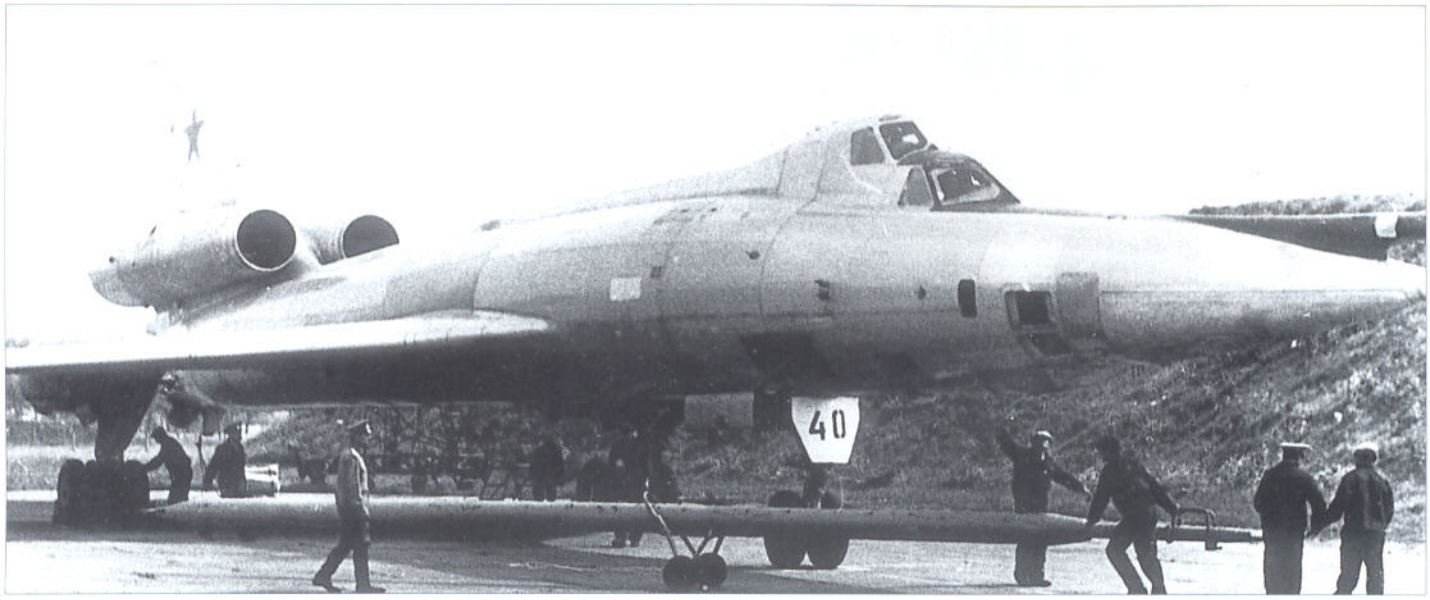
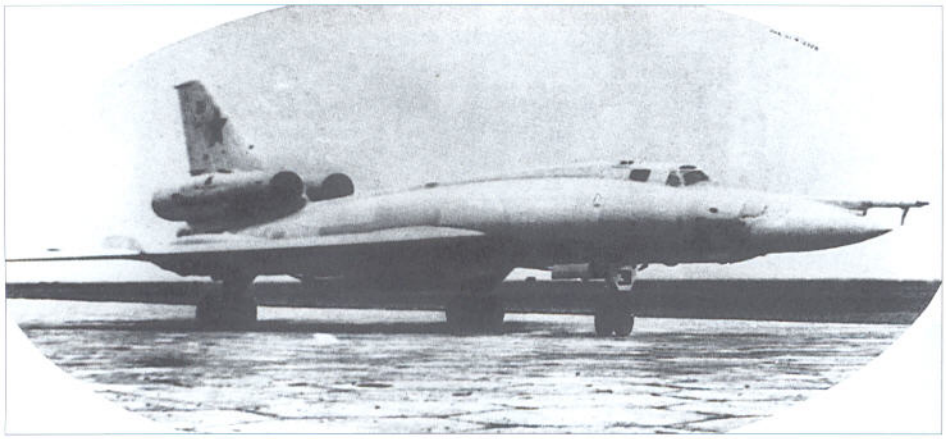


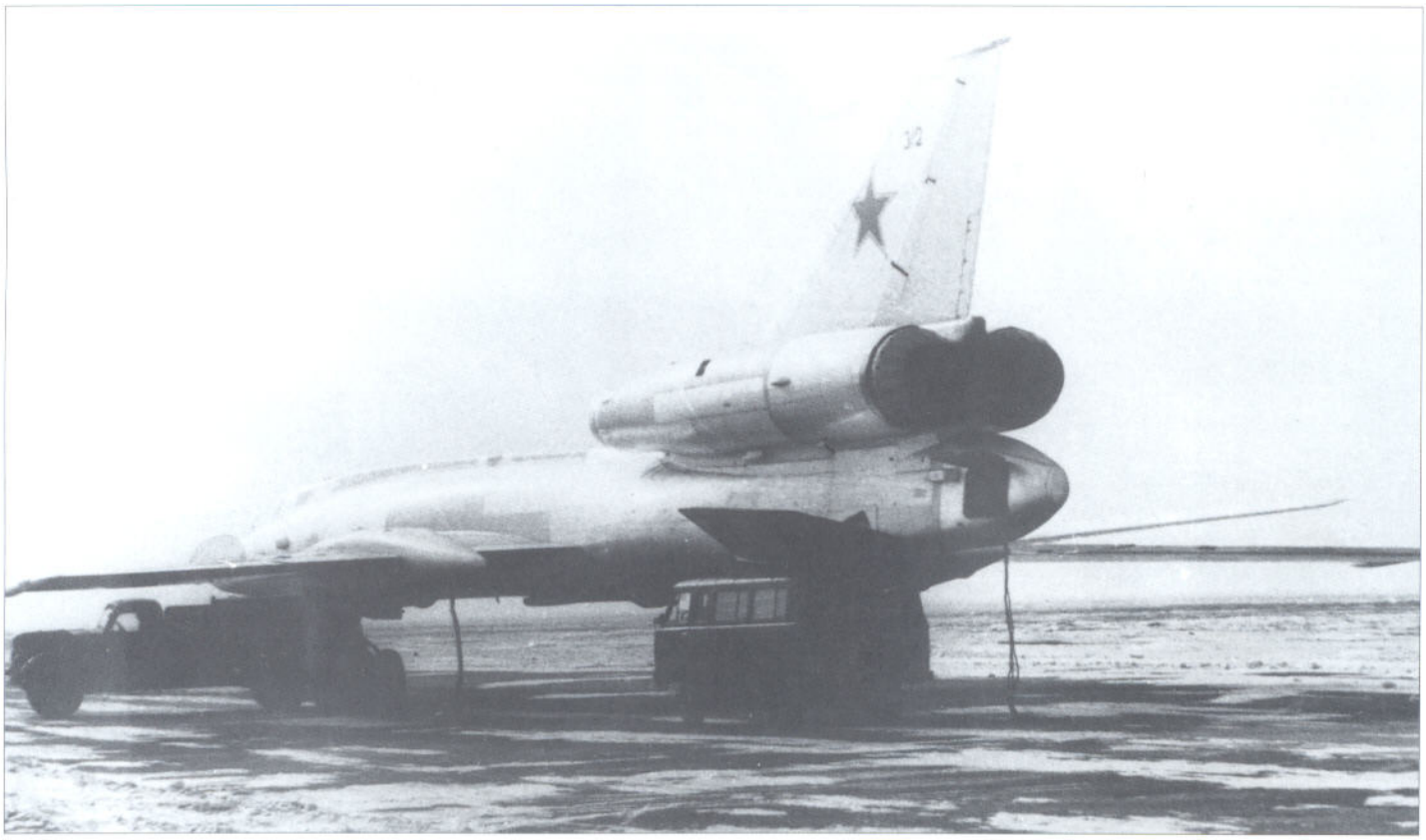




Above: **Probe-equipped Tu-22UD trainer.**
Yefim Gordon archive

Left: **A special experimental version of the Tu-22KD with two large bomb containers underneath the fuselage, each containing a large number of bomblets.**
Yefim Gordon archive

Below: **Tu-22PD with original tail profile.**
Tupolev OKB archive



'Blinder' Anatomy

The detailed description that follows applies mostly to the Tu-22R 'Blinder-C' ('Aircraft YuR' or 'AR'), with the differing features of other principal versions described as appropriate.

The Tu-22R is a long range supersonic reconnaissance aircraft with a crew of three, that can be readily converted to a bomber. It is an all-metal mid-wing monoplane with highly swept wings, two afterburning turbojet engines mounted on a pylon above the aft fuselage, and a conventional tail unit with all-flying slab-type stabilisers.

Technologically, the airframe consists of several sections and is made of D16A-TV duralumin sheets and profiles, V-95 high strength aluminium alloy forgings, AK-8 aluminium alloy, 30KhGSA and 30KhGSNA steel castings, ML5-T4 magnesium alloy and other materials. The fuselage has numerous access hatches for ease of maintenance.

Fuselage

The all-metal semi-monocoque stressed-skin structure is of basically circular section. Its shape is typical of the mid-1950s, with a sharply pointed nose, a V-shaped cockpit canopy and pronounced area-ruling at the wing/fuselage joint. A curious feature of the Tu-22 is the dorsal engine/fin pylon on the aft fuselage.

The fuselage is made up of five sections (F-1 to F-5). Section F-2 is the pressurised crew compartment; the other sections hold fuel cells and incorporate the nosewheel well, equipment/avionics bays, the bomb bay and the brake parachute housing.

The fuselage structure comprises 85 frames and 48 stringers; additional stringers are installed between the main ones in areas subject to extra stress. Cut-outs for access hatches and equipment locations (attachment points) are reinforced by longitudinal and transverse beams. The skin panels are made of D16A-TV and V-95 alloys and are 1.0 to 7.0mm (0.04 to 0.27in) thick; stress areas are reinforced with extra sheets mounted internally. Flush rivetting is used throughout.

Section F-1 (up to frame No.1) has eleven frames (unnumbered), stringers, duralumin skin and two beams flanking the cut-out for the radar scanner. The cut-out is closed by a glass fibre honeycomb radome which hinges open for maintenance.

Section F-2 (frames Nos.1 through 13) is a three-seat pressurised (ventilation-type) crew compartment. The forward panels of the pilot's cockpit glazing and the central panel of the navigator's glazing are made of birdstrike-resistant triplex silicone glass; the remainder of the glazing is Plexiglass. The pilot's cockpit features a set of flight controls and flight instruments. The navigator's compartment located

below and ahead of the cockpit features navigational instruments, the radar display and an OPB-15 optical bombsight.

Behind the pilot is the aft-facing gunner/radio operator's station with the radio switch panel, the displays of the PRS-3 'Argon-2' gun ranging radar and the TP-1 TV gunsight, and the gun controls. On the Tu-22U and Tu-22UD this is replaced by an elevated forward-facing instructor's cockpit with a separate windscreen and a second set of controls.

The crew enters via ventral hatches which are jettisoned prior to ejection; in the event of a belly-landing or ditching the crew uses dorsal emergency escape hatches. All rivet joints of the pressurised crew compartment are sealed with synthetic rubber compounds or rubber sealing tape. Aluminium armour plates (12mm – 0.47in thick) are mounted at floor level between fuselage frames No.3 and No.6 to protect the navigator from ground fire.

Section F-3 of the forward fuselage (frames Nos.13 through 33) accommodates the nose gear unit, Nos.1 and 2 fuel cells, strike cameras, inflatable rescue dinghy and other equipment and systems. The cockpit canopy (in section F-2) continues into a deep fuselage spine housing communications equipment.

Section F-4 (frames Nos.33 through 60) is the centre fuselage. The wing carry-through box is located between frames Nos.33 and 44, with the No.3 fuel cell above it. The space between frames Nos.44 and 60 is occupied by the bomb bay. This may house day cameras or an air-conditioned capsule with night cameras (on the Tu-22R), a BD-294F missile pylon (on the Tu-22K), bomb racks (on the Tu-22R and Tu-22K configured as a bomber) or ECM equipment (on the Tu-22P). The bomb bay hatch has reinforcing beams along the edges and is closed by doors, on the Tu-22R, these doors incorporate camera windows. When the aircraft is configured for the bomber role these windows are blanked off.

Section F-5 (frames Nos.60 to 85) is the aft fuselage. It carries the engine nacelles, tail unit, retractable tail bumper, brake parachutes and tail gun barbette (or a standardised strap-on ECM pod). Transverse tailplane mounting beams are attached to frames Nos.76 and 79.

Frames Nos.71 and 79 form the so-called fin bay; the upper part of it protrudes above the fuselage contour, forming a pylon to which the vertical tail, engines and engine nacelles are attached. The top of the fuselage between frames Nos.83 and 85 is flat and mounts the PRS-3 'Argon-2' gun ranging radar. The forward, centre and aft fuselage are joined at frames Nos.1, 13 and 33 by thermally-treated chrome-nickel bolts.

To reduce the landing run the Tu-22 is equipped with twin brake parachutes with an area of 52m² (559ft²) each. The parachutes are stored in a ventral bay between frames No.81 and 84 and can be deployed at up to 350km/h (217mph).

Wings

Cantilever mid-wing two-spar structure with small leading edge root extensions (LERXes). Leading-edge sweep 55°, anhedral 2.5°, incidence 1°. Aspect ratio 3.7, taper 3.68, average thickness-to-chord ratio 6.5 to 7%.

The wings have two prominent boundary layer fences on each side and faired anti-flutter weights at the wingtips. Construction of the wings comprises front and rear spars, main and auxiliary ribs, upper and lower skins and stringers.

Structurally the wing torsion box is made up of five parts – centre section, inner wings and outer wings. The centre section is integral with the fuselage and houses fuel cells. The inner wings (ribs Nos.1 to 14) are attached to the centre section by special bolts and fittings; they, too, house fuel cells and carry the main gear units, fairings and inboard flaps.

The outer wings (ribs Nos.14 to 29) are likewise attached to the inner wings by special bolts and fittings and also house fuel cells. They carry the outboard flaps and ailerons. There are no leading-edge devices; the leading edges of the inner and outer wings are detachable, as are the wingtip fairings.

Early production aircraft (up to Batch 23 – see Chapter Two) had single-slotted inner flaps with three screw jacks each; these were replaced by double-slotted flaps from Batch 24 onwards to improve field performance and minimise vibration.

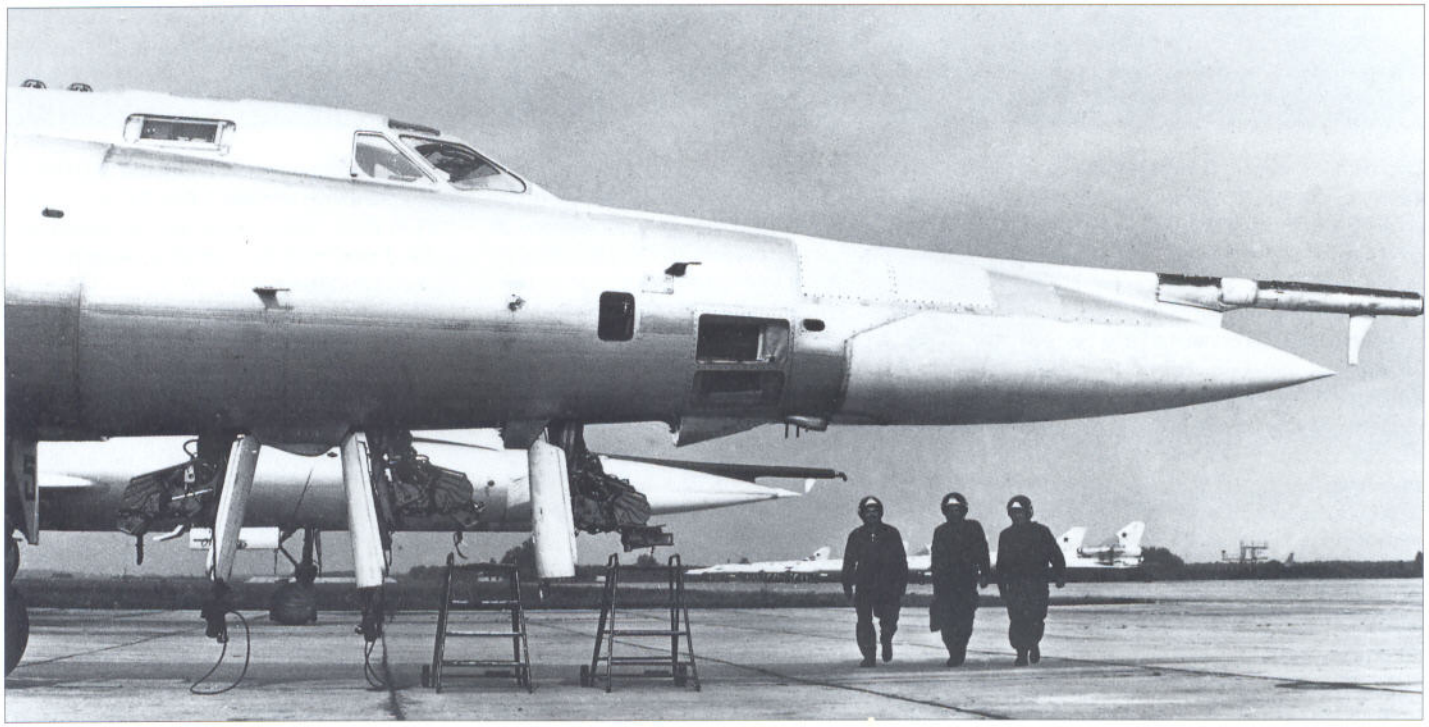
The outer flaps are single-slotted, with two screw jacks each. The flaps are electrically operated by an MPZ-16 central flap drive unit via drive shafts and angle gearboxes. The maximum deflection for the flaps is 35° for both take-off and landing.

So-called flap/ailerons for roll control at high Mach numbers were introduced on the outer wings from Batch 35 onwards. The wingtip anti-flutter weights were deleted at the same time because the new elastic main gear mounts had obviated the need for them.

The aerodynamically-balanced two-section ailerons have servo tabs.

Previous page: **Tu-22RD with the original tail, in use as an instructional airframe at the Irkutsk aviation high school.** Victor Kudryavtsev

Below: **Nose of a Tu-22KD. Note black-painted refuelling probe on the aircraft in the background.** Yefim Gordon archive



Tail unit

Conventional swept tail surfaces. The low-mounted all-flying stabilisers (or stabilators) have a symmetrical airfoil, 58° leading-edge sweep and 5° dihedral. They have a two-spar structure with 12 ribs each. Both stabilisers are rigidly connected, with no differential deflection capability. On late production aircraft the stabilisers may be set at +1° to –19° for pitch trim.

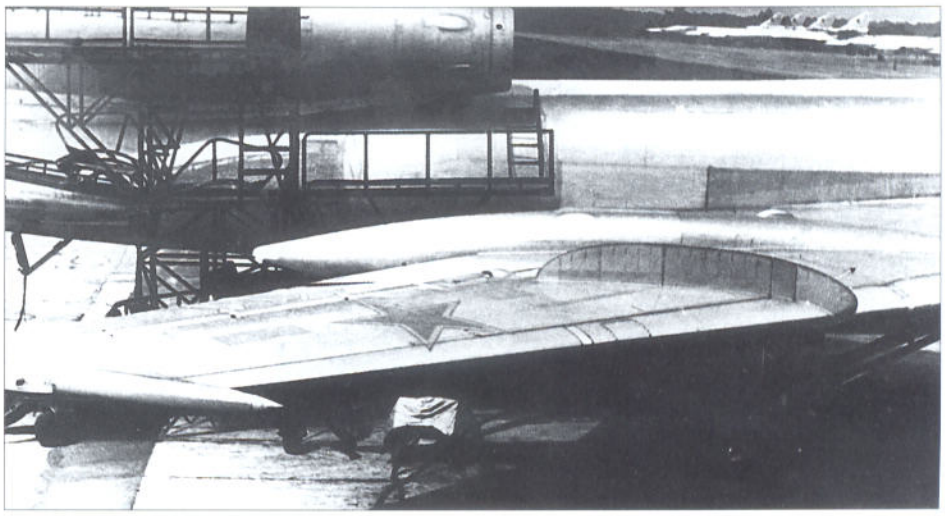
The fin has 56° leading-edge sweep, two spars, eleven ribs and a dielectric cap covering communications aerials. The single-spar aerodynamically-balanced rudder has a maximum deflection of 25° and is fitted with a trim tab which can be deflected 5°.

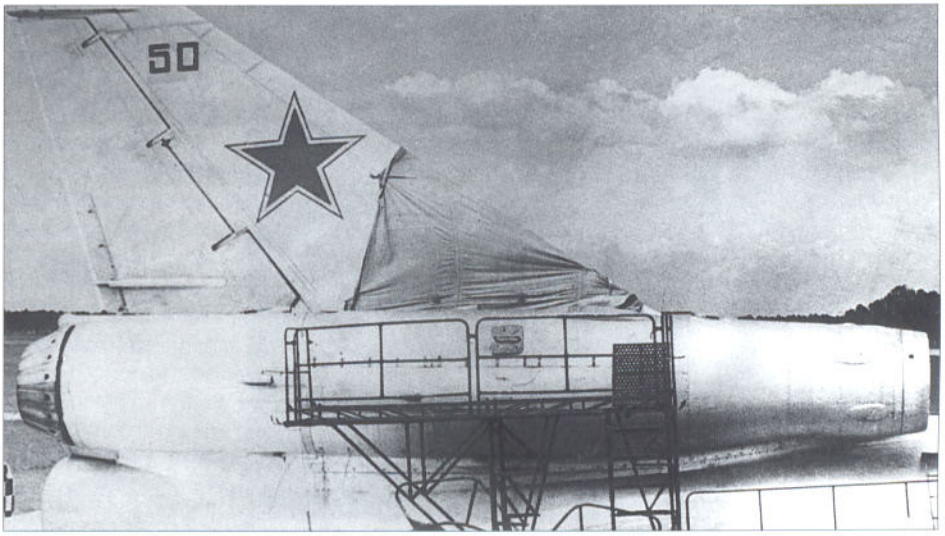
Landing gear

Hydraulically retractable tricycle type, with retractable tail bumper to protect the aft fuselage in the event of over rotation or tail-down landing. Wheel track 9.12m (29ft 11in), wheelbase in no-load condition 14.425m (47ft 4in).

The steerable nose unit has twin non-braking K2-1009 wheels (tyre size 1,000 x 280mm – 39.4 x 11.0in). The axle is located slightly aft of the oleo to prevent shimmy and the steering actuators double as shimmy dampers. The semi-levered-suspension main units have four-wheel bogies with KT-76/49 wheels (tyre size 1,160 x 290mm – 45.66 x 11.41in) and multiple disc brakes.

All three units retract aft, the main gear bogies rotating through 180° to lie inverted in prominent fairings extending beyond the wing trailing edge. This arrangement was traditional for Tupolev aircraft since the mid-1950s, having been pioneered on the Tu-16 'Badger'.





The wing of a Tu-22KD, showing the large fence and wingtip fairing. Yefim Gordon archive

Details of the RD-7M-2 engine nacelles. Yefim Gordon archive

Powerplant

Early Tu-22s were powered by two Dobrynin (RKBM) VD-7M afterburning turbojets rated at 102.9kN (23,148lb st) dry and 156.8kN (35,273 lb st) reheat. Later aircraft are powered by Dobrynin RD-7M2s with afterburning rated at 107.8kN (24,250lb st) dry and 161.7kN (36,375 lb st) reheat. Engine rpm is controlled by means of cable runs.

Both engines have a nine-stage axial-flow compressor, an annular combustion chamber, a two-stage axial flow turbine, a straight-through afterburner, a convergent-divergent nozzle and an accessories gearbox. Dual STG-18TBP starter-generators using ground power start the VD-7Ms; the RD-7M2 has a TS-29 jet fuel starter (auxiliary power unit).

The engines are located in nacelles attached to a common pylon forming the base of the fin and adhering directly to the aft fuselage. The nacelles are made up of three sections – forward (inlet), centre (incorporating attachment points for the engine) and rear (housing the afterburner).

The supersonic air intakes are fixed-area (ie, without movable ramps or centre bodies). The annular forward portions of the nacelles are moved forward hydraulically 188mm (7.4in) on take-off and landing, creating auxiliary air intakes. The intakes are raised above the fuselage to prevent boundary layer ingestion and engine surge.

Fuel capacity is 55,500 to 60,000 litres (12,210 to 13,200 Imp gallons). T-1 or TS-1 grade jet fuel is used. All fuel is held in non-self-sealing bladder tanks (7 or 8 in the fuselage and 24 in the wings). There is also a small supply of B-70 grade aviation gasoline in a separate tank for engine starting.

The fuel system is divided into two subsystems serving the port and starboard engine respectively, with a cross-feed valve so that either engine can draw fuel from any tank. Late Tu-22s had single-point pressure refuelling (via a ventral connector) and a fuel jettison system. A TATs 2-1V automatic fuel metering and transfer system ensures that the aircraft's cg stays within the prescribed limits as fuel is burned off during cruise. Fuel cells are pressurised with an inert gas mixture (carbon dioxide and nitrogen dioxide) to reduce the risk of explosion in case of battle damage or accident.

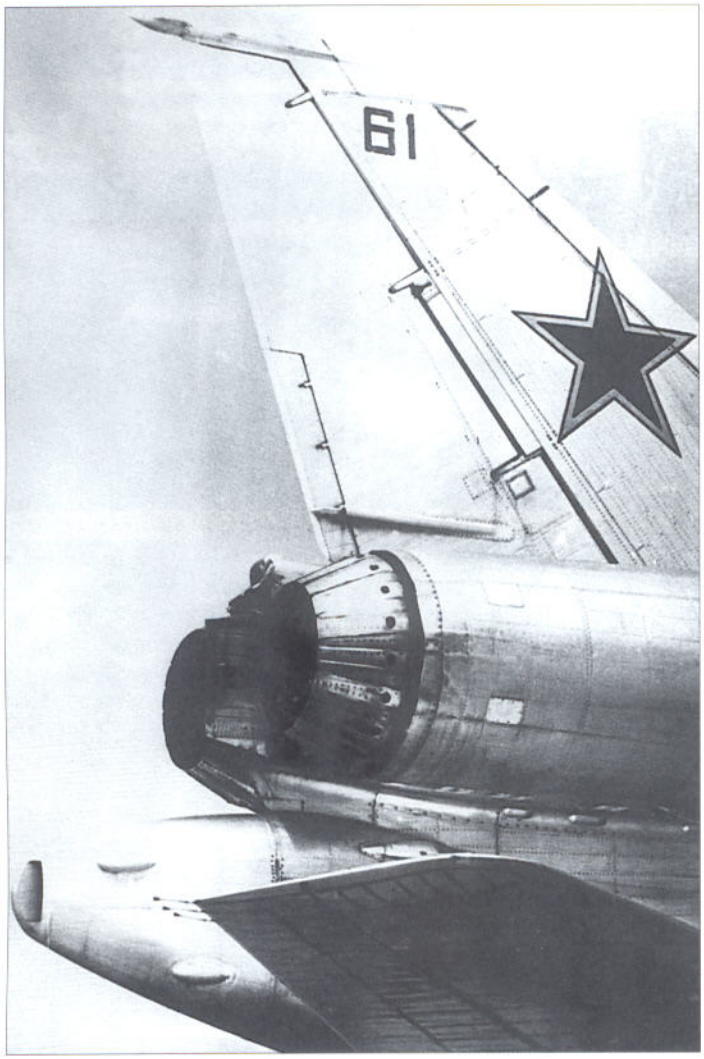
To extend their range, late versions of the 'Blinder' (Tu-22RD, 'KD, 'PD, 'UD etc) had flight refuelling capability, working with Tu-16N and Myasischchev 3MS-2 tankers. A fixed telescopic refuelling probe was mounted on the fuselage centreline ahead of the pilot's windscreen. The probe was 'fired' pneumatically into the tanker's drogue and locked mechanically into place before fuel transfer was begun. When refuelling was completed the probe retracted, disengaging itself from the drogue.

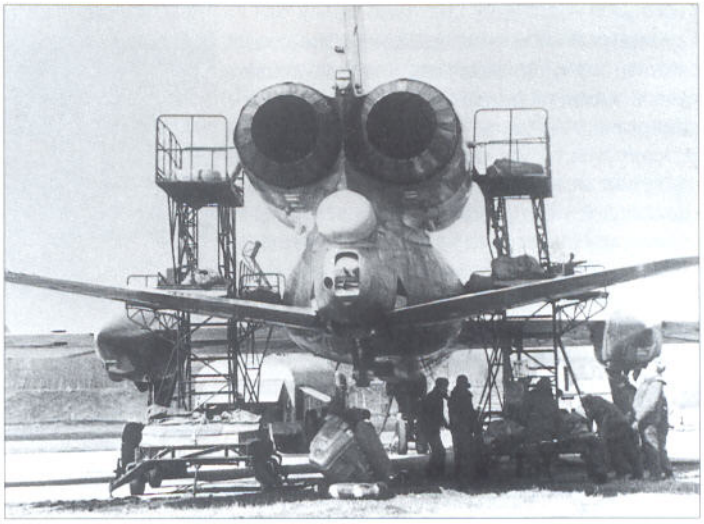
The Tu-22 can be fitted with two SPRD-63 jet-assisted take-off (JATO) bottles rated at 34.3 to 53.9kN (7,716 to 12,125lb st) each.

Armament

The Tu-22K is armed with a single Bereznyak Kh-22 air-to-surface missile. This is a tailed-delta missile with cruciform tail surfaces and a twin-chamber liquid-propellant rocket motor. In its main version the Kh-22 has semi-active radar homing (SARH), but active and passive radar homing versions also exist; the latter is an anti-radiation missile (Kh-22P).

The Kh-22 has a length of 11.65m (38ft 2.66 in), a wing span of 3.0m (9ft 10.11in), a launch gross weight of 5,635 to 5,770kg (12,422 to 12,770lb), a warhead weight of 900kg (1,984 lb), a range of 300 to 500 km (186 to 310sm)

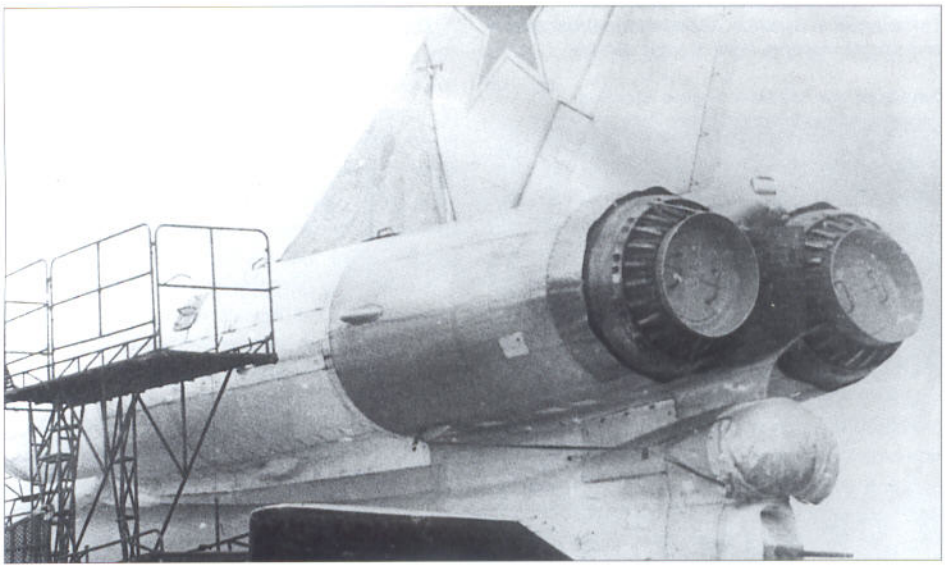




Above: **View of the tail of a Tu-22RD.**

Left: **Tu-22KD rear, showing the ECM fairing and RD-7M-2 engines.**

Below: **Tu-22 with VD-7M engines.**
All Yefim Gordon archive



depending on trajectory and a cruising speed of 3,000 to 3,600km/h (1,864 to 2,236mph).

The missile is carried semi-recessed in the bomb bay on a BD-294F rack and lowered clear of the aircraft's fuselage before being dropped. The rocket motor fires when the missile is at a safe distance from the aircraft.

The Tu-22R can be configured as a bomber. Free-fall general purpose (GP) bombs of various calibre are carried on KD3-105A or KD4-105A cassette racks. Typical options are six KD3-105A racks with three 250kg (551lb) or smaller bombs each or four KD4-105A racks with four medium-calibre bombs. In increased-payload configuration, modified aircraft can carry nine KD3-105A racks. Additionally, the Tu-22 has a single BD-105A beam-type rack for large-calibre bombs, including nuclear ones; it is non-detachable and effectively forms a part of the fuselage structure. The normal bomb load is 3,000kg (6,613lb); in overload condition the aircraft can take 12,000kg (26,455lb).

Bomb aiming is done using the OPB-15 optical bombsight or 'Rubin-1' ground mapping radar which, together with the navigation/bombing computer, form the R-1A navigation and attack system. Data on aircraft position are continuously fed to the system by the aircraft's navigation suite.

The 9A242 defensive armament system comprises a DK-20 remote-controlled tail gun barbette with a single 23mm (0.90 calibre) Rikhter R-23 gun. The barbette is electrohydraulically actuated and the gun is aimed automatically, using the PRS-3 'Argon-2' gun ranging radar and TP-1 TV sight. The R-23 is a single-barrel gun with a multi-chamber revolving loading mechanism actuated by gun blast gases. Its rate of fire is about 2,500rpm.

Avionics and equipment

The flight instrument suite includes the VD-20 altimeter, KUS-1000 airspeed indicator, EUP-53 turn indicator, KI-13 magnetic compass, AGD-1 or AGB-1 artificial horizon, PPD-1 pitot head, M-2.5 Mach meter, AM-10 accelerometer, slipstream pressure indicator, TsSV-3M central speed and altitude indicator, TsGV-DS-2 central vertical gyro and AUASP-10R automatic alpha/g load limiter.

The AP-7MT electric autopilot stabilises the aircraft along all three axes, enables automatic flight along a preset course determined by the KS-6A automatic approach system, executes turns, climb and descent and provides inputs to the pilot's pitch and bank indicators, navigation/bombing computer and OPB-15 bombsight. The KS-6A automatic approach system determines and indicates the aircraft's heading, turn angles, magnetic bearings on VOR beacons and provides magnetic heading information to various avionics items (eg, missile guidance system). The 'Poot'-4K' (way) navigation system determines the aircraft's location. Astronavigation uses the BTS-63 astrosextant mounted on the fuselage spine immediately aft

of the cockpits; this is usually used only to check for possible navigation errors.

Powerplant and systems operation is monitored using the following equipment: RTD-4 fuel flow meter; EM-220, EM-100T and EDMU-15 electric pressure gauges; DIM-80T induction-type pressure gauge; UPRT-2 fuel cock position indicator; ITE-2 RPM gauge; TST-29, 2TVG-366, 2TVG-411 and DTUE-111 temperature gauges; SDU-3A6 pressure gauge; URVK airflow meter; RIO-2M radiation-type icing indicator; UPS-4 stabiliser trim indicator; UPZ-47 flap position indicator.

For mission debriefing or accident investigation the Tu-22 is equipped with three flight data recorders (KZ-63, MSRP-12, KG-713M) and an MS-61 cockpit voice recorder.

Navaids include the RSBN-2S 'Svod' (dome) short-range system (SHORAN); DISS-1 Doppler radar (ground speed and drift indicator); ARK-11 and ARK-92 ADF; RV-4 (RV-UM) low altitude radio altimeter (0 750m – 2,460ft) which doubles as a ground proximity warning system; RV-25 high altitude radio altimeter; KRP-F VOR/localiser and GRP-2 glideslope receivers and MRP-56P marker beacon receiver forming part of the SP-50 ILS.

Communications equipment comprises an SPU-7 intercom, R-802G and R-832M HF ATC radios, R-836 and R-847 UHF comms radios (transceivers), an R-876 receiver and an R-851 emergency call radio. The aircraft is equipped with an SRZO-2M 'Khrom-Nikel' (ASCC 'Odd Rods') IFF transponder and an SOD-57M ATC transponder.

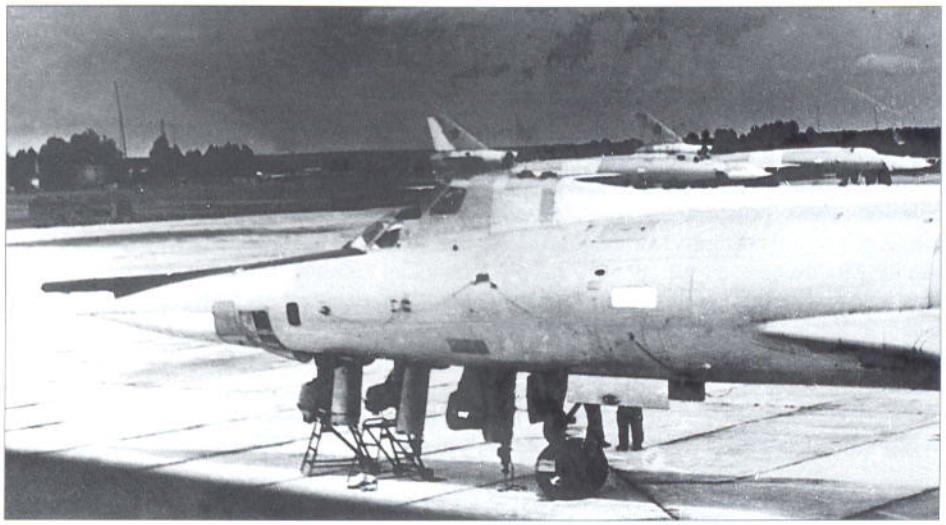
The Tu-22R and 'RD, Tu-22P and 'PD and Tu-22U and 'UD are equipped with an R-1A 'Rubin-1A' ('Short Horn') ground mapping radar; the Tu-22K and 'KD have a PN ('Puff Ball') search/target illumination radar.

The Tu-22R/RD can carry various day and night recce cameras in various combinations, including the AFA-41/20 plan view camera, AFA-42/100 oblique camera, AFA-42/20, AFA-40 (both day) and NAFA-NK-75 (night) twin cameras and the FARM-2 photo adapter for filming the radar screen.

Versions of the Tu-22 differ in active and passive ECM fits. Passive ECM includes APP-22 and KDS-16 chaff/flare dispensers; the former are used for 'collective' defence in formation flying and the latter for individual aircraft defence. All Tu-22s have an SPO-3 'Sirena-3' radar homing and warning system (RHAWS).

Control system

The Tu-22 has single controls (except the Tu-22U and 'UD which have dual controls) with a control column, rudder pedals and cable/push-pull rod control linkages. All control surfaces are hydraulically actuated; if two hydraulic systems fail the rudder and ailerons can be controlled manually. In a twin system failure, the stabilators are controlled either by a third (emergency) hydraulic system. If that also fails, control can be achieved by the MUS-5 electric pitch trim mechanism alone.



Nose detail of a Tu-22UD, showing the three downward firing K-22 ejection seats.
Yefim Gordon archive

In standard mode the stabilators, rudder and ailerons are controlled by irreversible hydraulic actuators (the RP-21A, RP-23U and RP-22U). The rudder and ailerons have electrically-actuated trim tabs.

The control circuits have artificial 'feel' units. The pitch channel has a DT-105A damper to prevent pitch oscillations. An AU-105A stability augmentation system improves pitch stability and control at speeds below Mach 1. Yaw and roll oscillations are neutralised by the D-2K-115 damper serving the rudder and aileron control circuits. Dry friction dampers are also fitted.

From production Batch 35 onwards the ailerons are responsible for roll control at up to Mach 0.9 only. At higher speeds they are locked in to the neutral position and roll control passes to the outer flaps (the so-called flap/ailerons). This prevents aileron reversal as the the Tu-22's wings are regarded as rather aeroelastic).

Crew escape system

The Tu-22 is equipped with downward-ejecting K-22 ejection seats. This limits the minimum safe ejection altitude to 2,000m (6,561ft). The pilot and navigator face forward and the gunner/radio operator faces the tail; the instructor pilot on the Tu-22U also faces forward.

The seats double as crew elevators for boarding and egress, sliding up and down on rails attached to the access hatch covers. The latter are jettisoned automatically before ejection. Dorsal escape hatches are also provided for crew rescue in the event of a belly-landing or ditching. An LAS-5M-2 inflatable rescue dinghy with a capacity of 550kg (1,212lb) is stored in a compartment on the starboard side of the fuselage immediately aft of the cockpits.

Hydraulics

The Tu-22 has three independent hydraulic systems: No.1 (main), No.2 (main) and No.3 (emergency). A separate hydraulic power unit with an NP-48 pump actuates the windshield wipers.

Some equipment items are powered by both No.1 and 2 systems for greater reliability; this includes all rudder, aileron and stabilator actuators. No.3 system powers the stabilators if both main systems fail and is responsible for emergency landing gear extension.

Both main hydraulic systems are powered by engine-driven NP-43 hydraulic pumps. The emergency hydraulic system is powered by two ATN-15 ram air turbines located in the inner wings and driving NP-43 pumps. All systems use AMG-10 hydraulic fluid and have an operating pressure of 210kg/cm^2 (3,000lb/in^2).

Electrics

The Tu-22 has four electric subsystems:

1 27 volt DC with four STG-18TBP starter-generators (on VD-7M-powered aircraft) or four GS-18TP generators (on RD-7M2 aircraft) and two 12SAM-55 batteries as backup power;
2 115 volt/400Hz single-phase AC with three PO-6000 AC converters (one is a backup in case one of the other two fails). Some vital equipment is powered by separate PO-500 or PO-500A converters;
3 36 volt/400Hz three-phase AC with two PT-1000VS AC converters (one is a backup) and one PT-200Ts converter for powering gyroscopic equipment;
4 200 volt /366.6 to 580Hz three-phase AC with two SRS-30-8 generators for powering equipment which is impervious to AC frequency alterations.

Air conditioning system

The crew compartment and avionics bays with sensitive equipment are pressurised and heated by suitably cooled air bled from the 7th compressor stage of the engines.

Oxygen system

The oxygen equipment enables the crew to continue to operate if the cockpit decompresses. Prolonged operation is possible at altitudes

of up to 12,000m (39,370ft) and brief operation at up to 14,000m (45,931ft). This also allows unlimited crew operation in a pressurised cockpit at up to 14,000m and ensures crew survival during ejection at up to 14,000m.

Liquid oxygen is stored in bottles and converted to gaseous state in the SKT-15M oxygen converter which feeds it to the crew's oxygen masks at a preset pressure. Normally the crew use KP-24M oxygen sets with KM-32P oxygen masks. In an ejection, oxygen supply switches automatically to the KP-23 portable oxygen set.

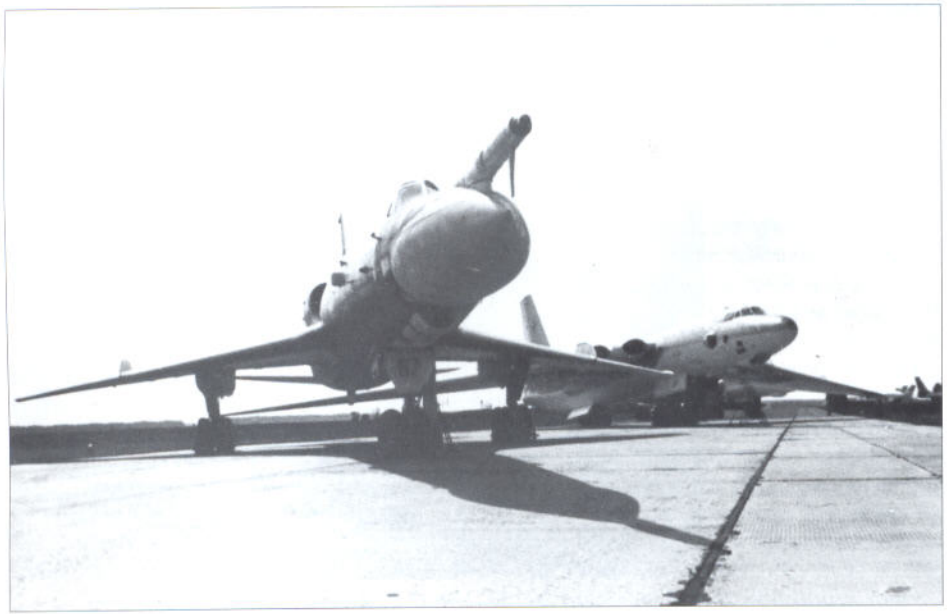
Pneumatic system

Compressed air at 150kg/cm² (2,142lb/in²) is supplied by two engine-driven compressors and accumulated in ten air bottles. It is used for fuel jettisoning, brake parachute deployment and release etc.

Fire suppression system

The Tu-22 is equipped with an SSP-2A fire warning system and chlorofluorocarbon fire extinguisher bottles for fighting engine fires. The engines are separated from the airframe by titanium firewalls. The crew also has portable CO_2 fire extinguishers for fighting cockpit fires.

Tu-22KPD 'Red 67' on display at Poltava airbase in the Ukraine. Behind is a Myasischchev 'Bison'. Yefim Gordon archive



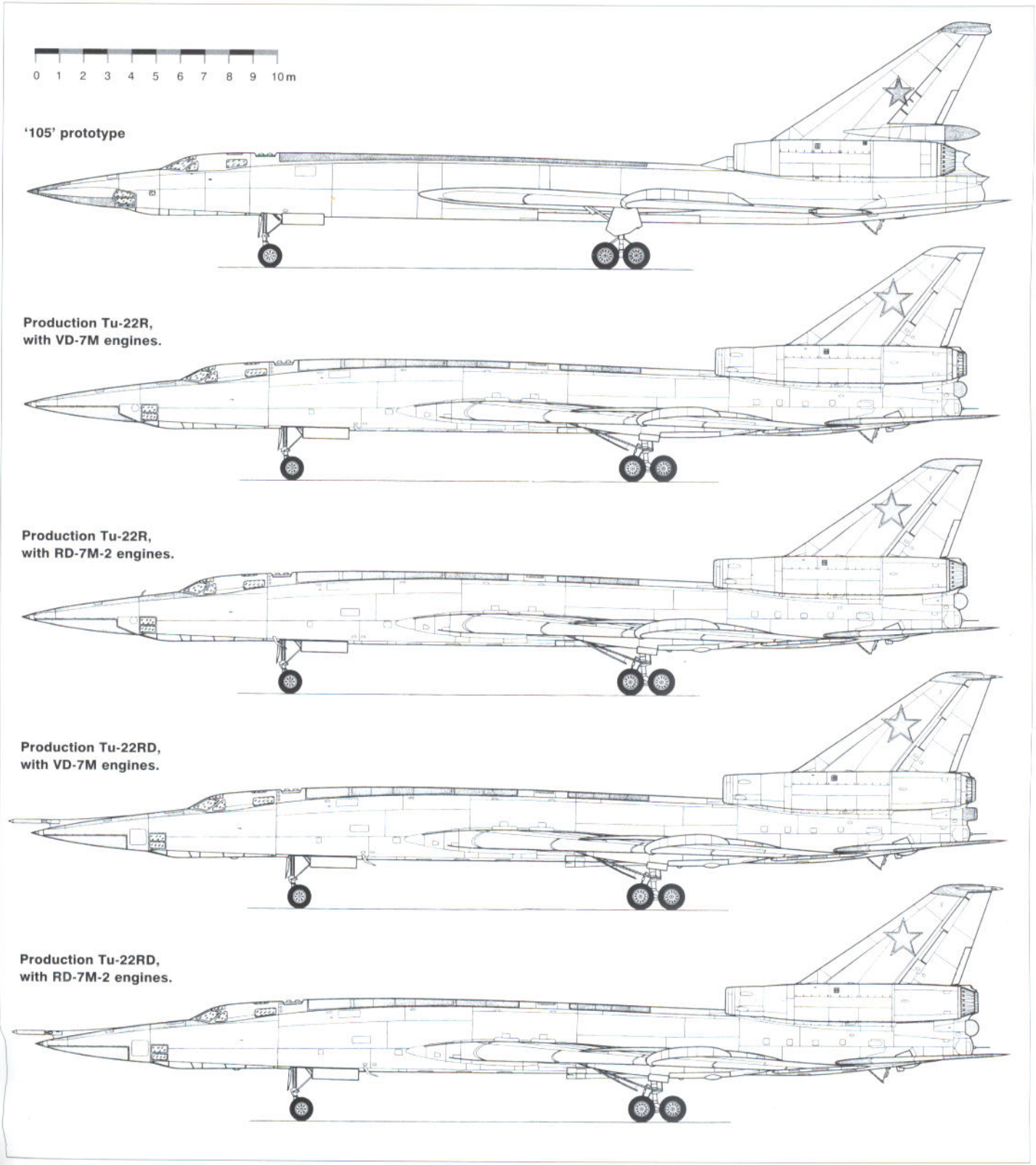
Tu-22 'Blinder' family specifications

	Tu-105 prototype	Tu-105A prototype	Tu-22R early	Tu-22R late
First flight	1958	1959	1961	1965
Powerplant	2 x VD-7M	2 x VD-7M	2 x VD-7M	2 x RD-7M2
Rating in full	2 x 156.8kN	2 x 156.8kN	2 x 156.8kN	2 x 161kN
	2 x 35,273lb st	2 x 35,273lb st	2 x 35,273lb st	2 x 36,375lb st
Length	41.995m	41.6m	41.6m	41.6m
	137ft 9.3in	136ft 5.79in	136ft 5.7in	136ft 5.7in
Height	10.995m	9.43m	10.0m	10.04m
	36ft 0.8in	30ft 11.2in	32ft 11.2in	32ft 11.2in
Wing span	23.745m	23.646m	23.64m	23.64m
	77ft 10.8in	77ft 6.9in	77ft 6.9in	77ft 6.9in
Wing area	166.6m²	162.25m²	162.25m²	162.25m²
	1,791.39ft²	1,744.62ft²	1,744.62ft²	1,744.62ft²
Wing leading edge sweep	52°	55°	55°	55°
Take-off weight	80 ton	85 ton	92 ton	92 ton
	176,366lb	187,389lb	202,821lb	202,821lb
Top speed	1,450km/h	1,510km/h	1,410km/h	1,600km/h
	901mph	938mph	876mph	994mph
Range, subsonic	5,800km	5,850km	5,650km	5,650km
	3,604sm	3,635sm	3,510sm	3,510sm
Service ceiling	13,600m	14,700m	13,500m	13,500m
	44,619ft	48,228ft	44,291ft	44,291ft
Take-off run	2,250m	1,950m	2,830m	2,300m
	7,381ft	6,397ft	9,284ft	7,545ft
Landing run	1,420m	1,370m	1,700m	1,600m
	4,658ft	4,494ft	5,577ft	5,249ft
Crew	3	3	3	3
Payload	3 to 9 tons	3 to 9 tons	3 to 9 tons	12 tons
	6,613 to 19,841lb	6,613 to 19,841lb	6,613 to 19,841lb	26,455 lb

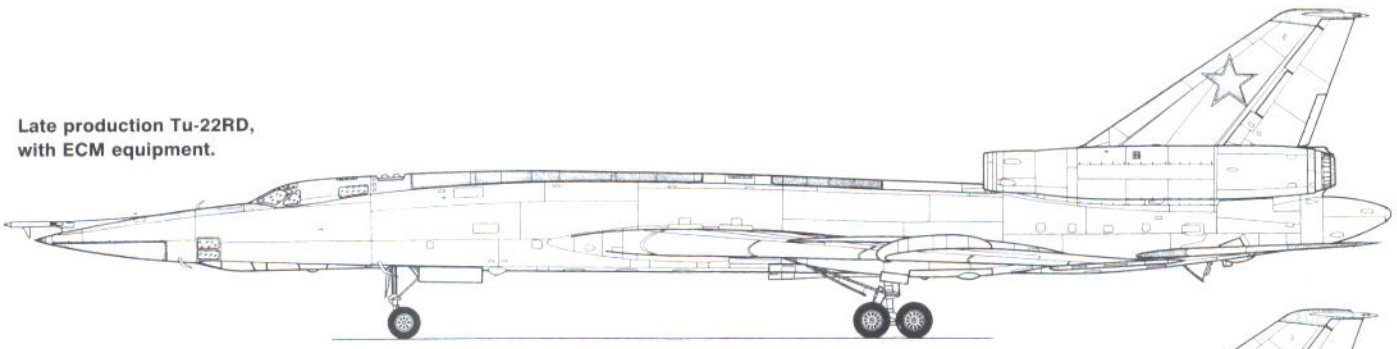
Tu-22R (Tu-22RD) with VD-7M engines Specification

Length – without IFR probe	41.04m	134ft 8in
– with refuelling probe	42.6m	139ft 9in
Fuselage length	38.94m	127ft 9in
Height on ground	9.7m	31ft 10in
Wing span	23.64m	77ft 6.9in
Max fuselage cross-section	6.35 m²	68.28ft²
Wing area – minus LERXes	151.25m²	1,626.34ft²
– with LERXes	162.25m²	1,744.62ft²
Sweepback at quarter-chord	52° 14' 30"	
Wing thickness-to-chord ratio	6%	
Mean aerodynamic chord	7.08m	23ft 3.1in
Wing aspect ratio	3.7	
Wing taper	3.68	
Wing anhedral	2.5°	
Wing incidence	1°	
Aileron area	11.32m²	121.72ft²
Flap area	23.84m²	256.34ft²
Stabilator span	10.0m	32ft 9in
Stabilator area	40.0m²	430.1ft²
Stabilator sweepback at quarter chord	55° 08' 22"	
Fin height	3.87m	12ft 8.3in
Vertical tail area	22.01m²	236.66ft²
Fin sweepback, quarter chord	50°	
Rudder area	6.08m²	65.37ft²
Landing gear track	9.12m	29ft 11.0in
Landing gear wheelbase	14.465m	47ft 5in
Maximum take-off weight	92,000kg	202,821lb
Empty weight – Tu-22R	46,300 to 46,440kg	102,072 to 102,380lb
– Tu-22RD at night, no IFR	47,320kg	104,320lb
– with probe	47,490kg	104,695lb
– Tu-22RD by day, no probe	47,230 to 47,400kg	104,122 to 104,497lb
– with probe	47,590 to 47,760kg	104,916 to 105,291lb
Normal landing weight	56,000kg	123,456lb
Maximum fuel load	44,750kg	98,655lb
Top speed – at TOW	69,000kg	152,116lb
– full military power	at 10,000m 1,035km/h	32,808ft 643mph
– full afterburner	at 10,000m 1,480km/h	32,808ft 919.6mph
– full afterburner	at 11,000m 1,600km/h	36,089ft 994mph
Cruising speed – subsonic	950 to 1,000km/h	590-621mph
– supersonic cruise	1,200 to 1,300km/h	745-807mph
Max cruise Mach 1.4	at 11,000m	36,089ft
Range – subsonic cruise		
– with 5% fuel reserves at MTOW with 3,000kg (6,613lb) of bombs	5,000km	3,106sm
– in supersonic cruise	1,800km	1,118sm
Ferry range –		
– with TOW at	69,000kg	152,116lb
at ...	860km/h	534mph
and ...	500m	1,640ft
	2,700km	1,677sm
Service ceiling –		
– with TOW at	69,000kg	152,116lb
– at full military power	11,000m	36,089ft
– in full afterburner	12,500m	41,010ft
Climb to height –	8,000m	26,246ft
– at full military power, and MTOW	13.5 minutes	
– in full afterburner, TOW at	85,000kg 10.5 minutes	187,389lb
Take-off run:		
– at full military power, and MTOW	2,700m	8,858ft
– in full afterburner, TOW at	85,000kg 2,250m	187,389lb 7,381ft
Landing run at landing weight	65,000kg	143,298lb
– brake parachutes deployed	1,900m	6,233ft

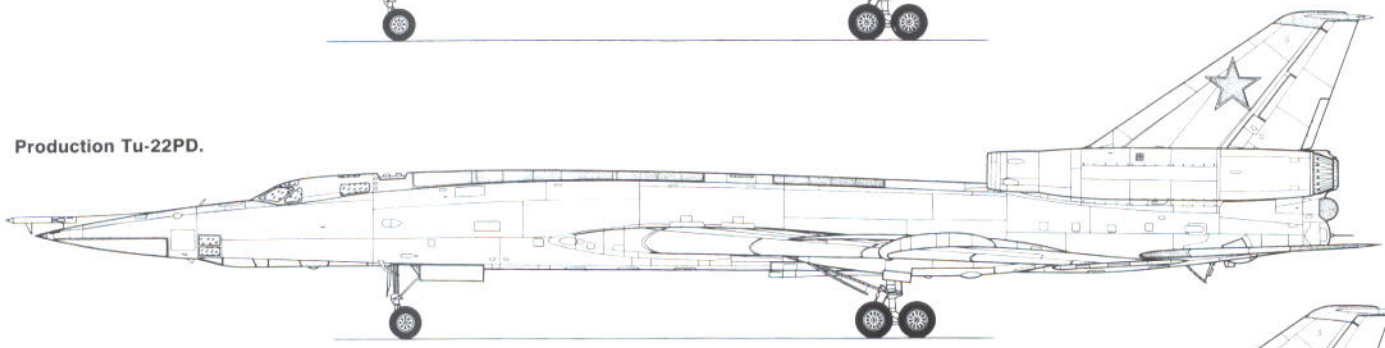
'Blinder' in Profile



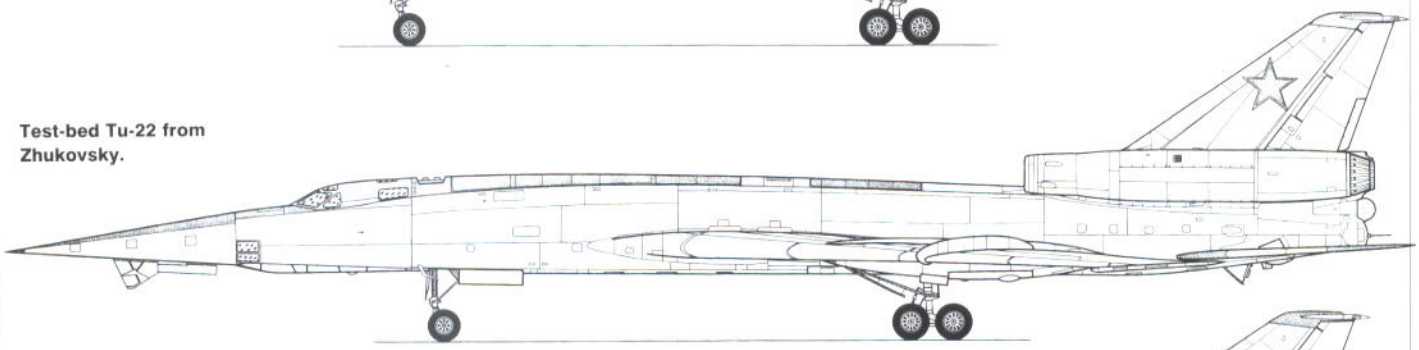
Late production Tu-22RD, with ECM equipment.



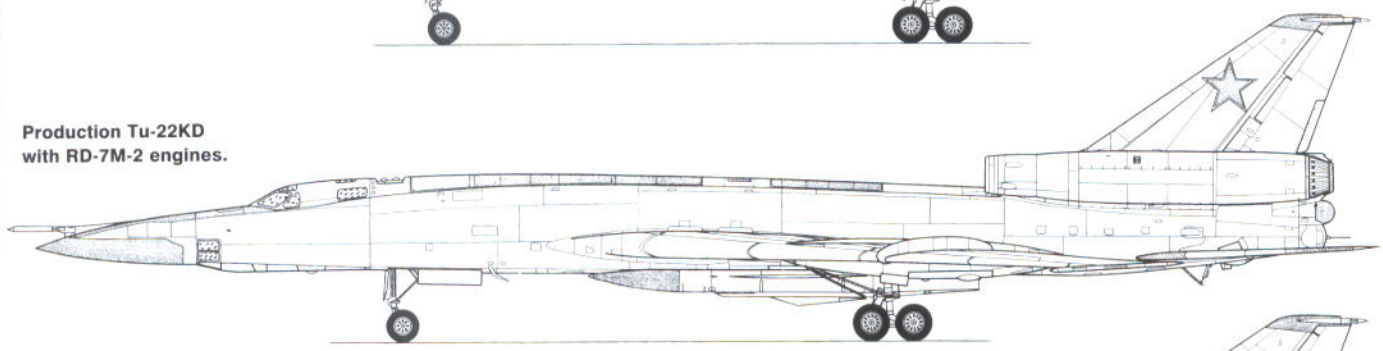
Production Tu-22PD.



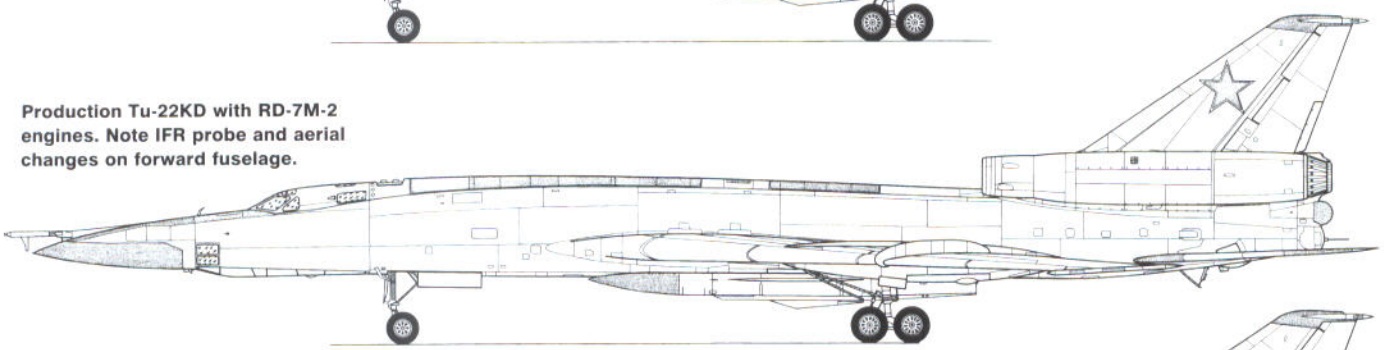
Test-bed Tu-22 from Zhukovsky.



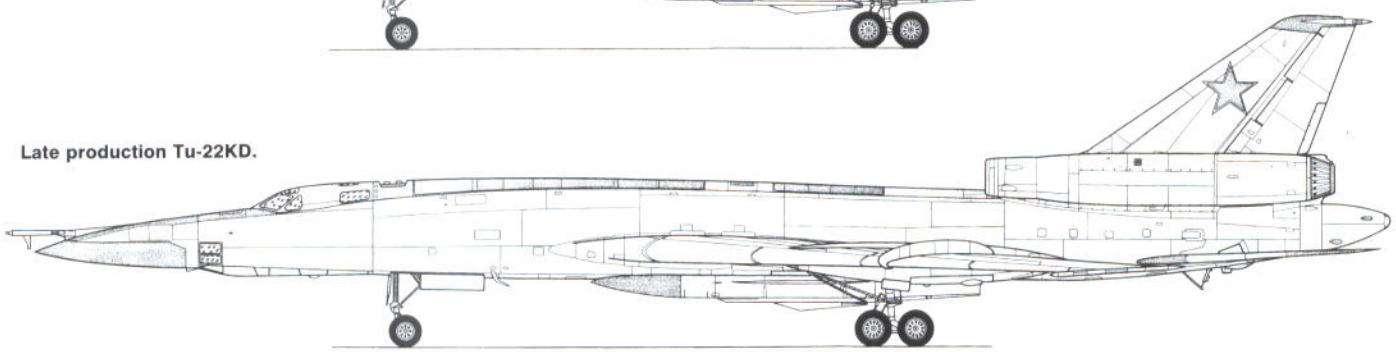
Production Tu-22KD with RD-7M-2 engines.



Production Tu-22KD with RD-7M-2 engines. Note IFR probe and aerial changes on forward fuselage.



Late production Tu-22KD.



'Blinder' in Colour

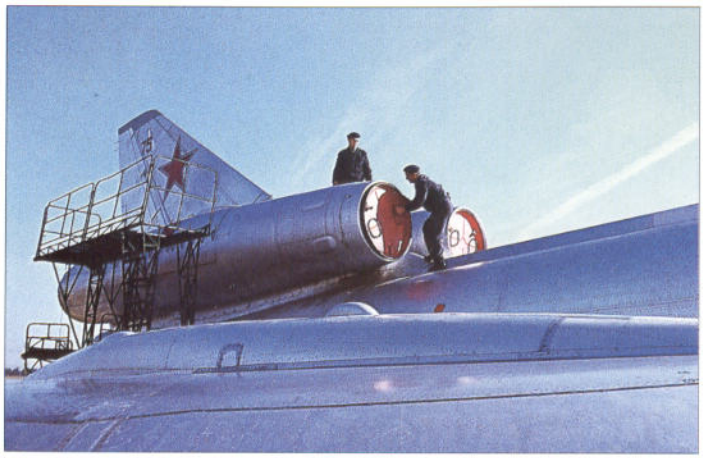
Right: **IFR-equipped Tu-22R in flight.** Yefim Gordon archive

Below: **Tu-22 test-bed 'Red 05' in the snow at LII, Zhukovsky.** Yefim Gordon

Bottom: **Early Tu-22 under test.** Tupolev OKB archive

Top: **Tu-22R 'Red 75' with RD-7M-2 engines. Note the maintenance gantries.** Yefim Gordon archive

Above: **'Red 14' a Tu-22RDM at Ryazan. The 'RDM combined reconnaissance and ECM capability.** Yefim Gordon

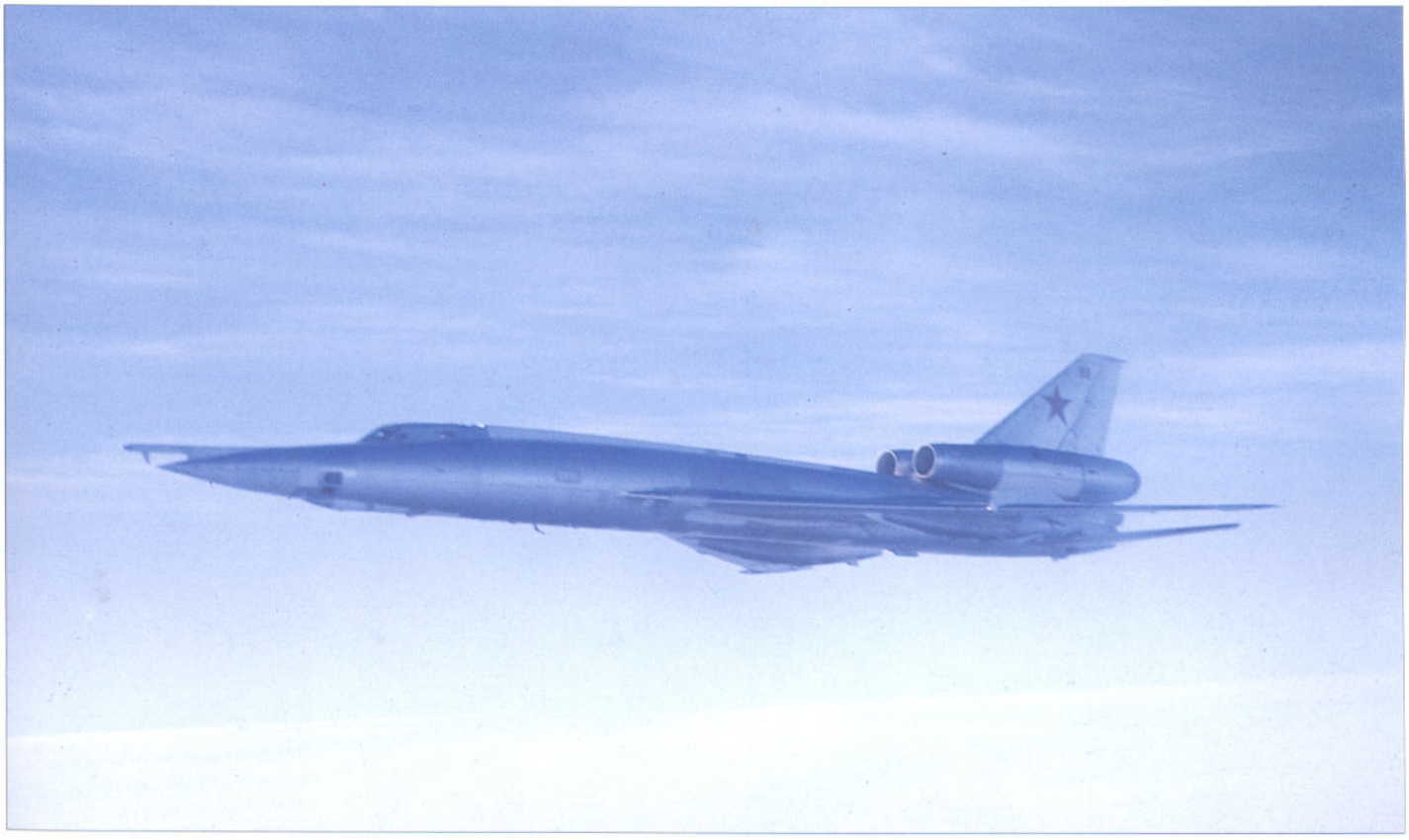


Top left and right: **Tu-22R with RD-7M-2 engines – the personnel give scale.** Yefim Gordon archive

Above: **Tu-22RD 'Red 36' in semi-derelict condition at the technical and engineering school at Tambov.** Yefim Gordon

Above: **Tu-22RD bomb bay.** Yefim Gordon

Below: **IFR-equipped Tu-22R in flight.** Yefim Gordon archive



Photographs on the opposite page:

Top left: **Wide-angle aspect of a Tu-22KD, giving good testament to why the type often was called the 'Sheelo' (awl).** Yefim Gordon

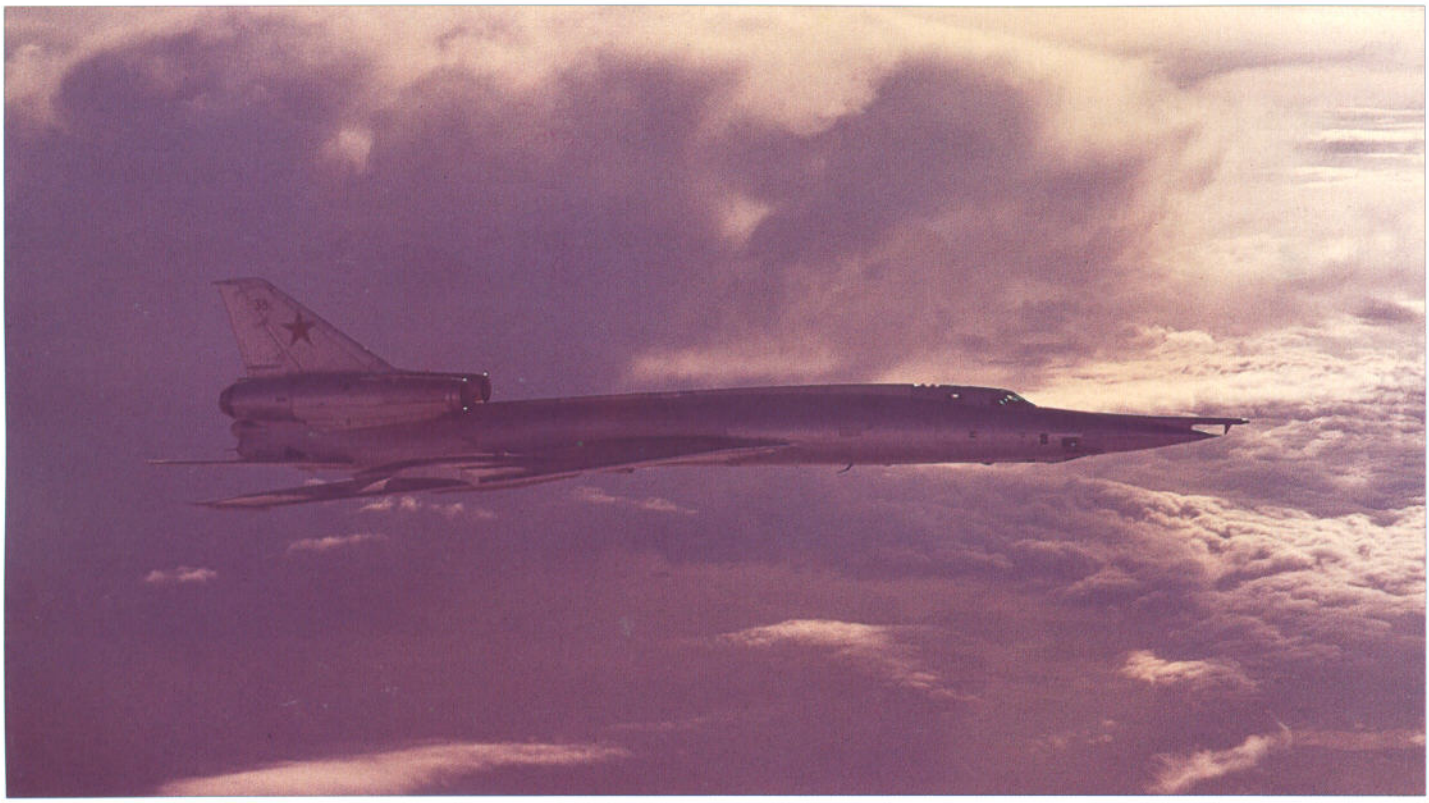
Top right: **Close-up of the nose of a Tu-22KD at Engels.** Yefim Gordon

Centre right: **Impressive fire-breathing dragon logo on the side of a Tu-22KD.** Sergei Popsuevich

Bottom: **Three Tu-22KDs at Engels, with 'Red 67' in the foreground and 'Red 77' to the rear.** Yefim Gordon

Photographs on this page:

Top and below: **Two views of ECM-configured Tu-22PD 'Red 41' at Engels. Stencilling on the fin forward and below of the red star is of interest.** Yefim Gordon



Pleasing air-to-air views of Tu-22RDs – note the IFR probes.
Both Yefim Gordon archive

Above: **'Red 12', a Tu-22KD at Ryazan. Note the large areas of the fuselage that have apparently been coated in a primer.** Yefim Gordon

Right: **Front view of Tu-22KD 'Red 21' at Ryazan, Long Range Aviation's training centre.** Yefim Gordon

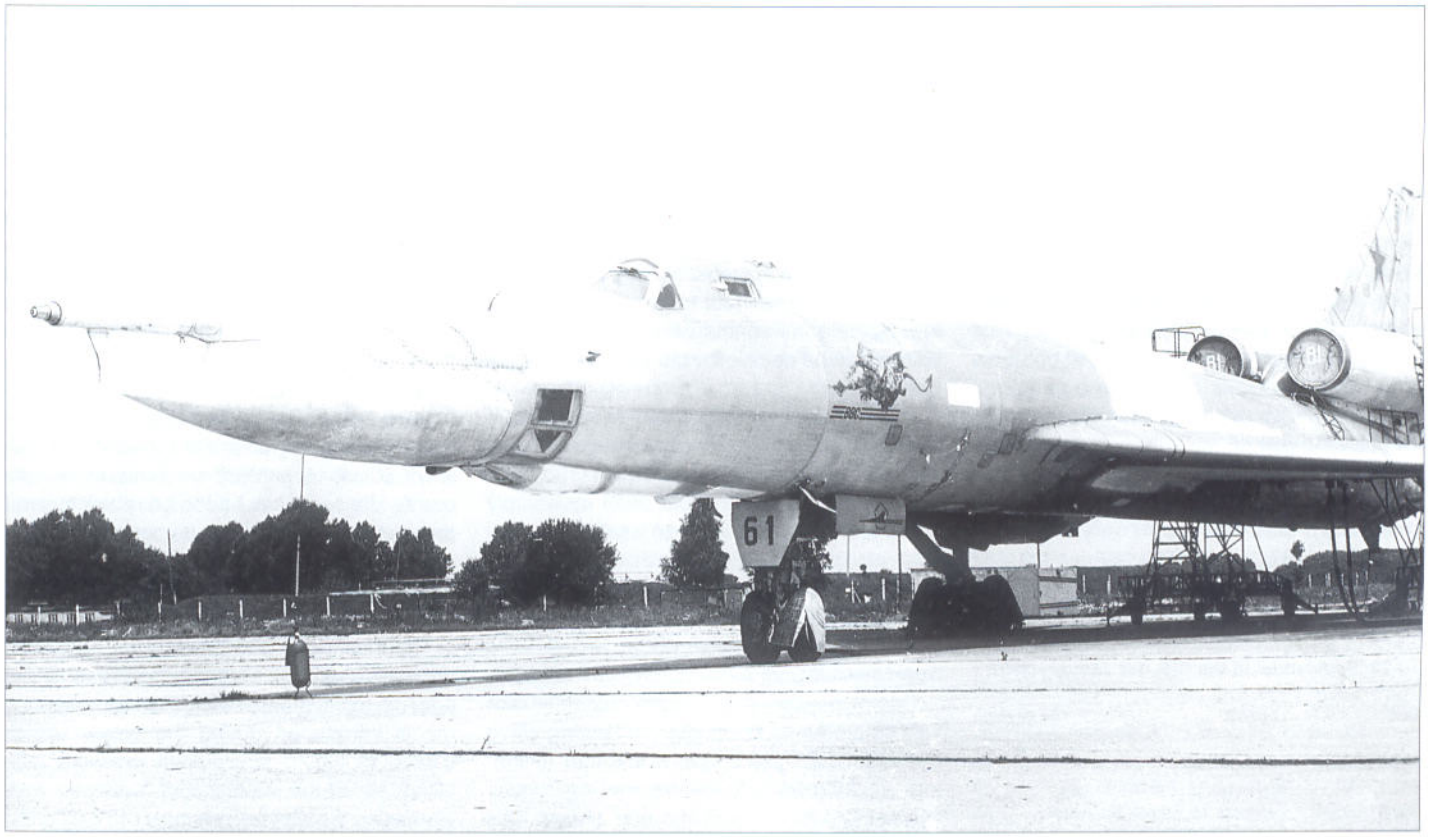
Below: **Tu-22KD 'Red 21' at Ryazan.** Yefim Gordon

Above: **'Blinder' line-up at Ryazan, central is the distinctive 'hump' of a Tu-22UD.** Yefim Gordon

Right: **'Red 10', a Tu-22UD trainer, showing the rear fuselage fairing.** Yefim Gordon

Below: **Detail of the crew seats of a Tu-22UD in lowered position.** Yefim Gordon

'Blinder' in Service and Action



Tu-22KD missile strike variant at Poltava, Ukraine – the last operational base for the Blinder. Supported by Tu-22Ps, 'KDs were tasked with the destruction of NATO bases and western naval fleets.
Sergei Popsuyevich

Deliveries to the VVS commenced in 1962, initially to the 42nd Combat Training Centre (the equivalent of an operational conversion unit) at Dyaghilevo airbase near Ryazan. A year later the Tu-22 achieved initial operational capability (IOC) with the 46th VA (Vozdooshnaya Armiya – air army or air force) based in western Russia, the Ukraine and Belorussia.

The 203rd Dahl'niy Bombardeerovochnyy Aviapolk (long range bomber regiment or heavy bomber wing, DBAP) based at Baranovichi in Belorussia had the distinction of being the first service unit to operate the 'Blinder'. On 1st April 1963, I V Sysoyev, the division's deputy CO, ferried the first Tu-22R from Kazan; two more aircraft arrived a few days later. In reality, they were just 'visitors' destined for the 290th OGDRAP (then flying Tu-16R 'Badgers') whose home base of Zyabrovka had closed for reconstruction, and the aircraft moved there as soon as the work was finished. Re-equipment was hampered by slow deliveries, and the 290th OGDRAP's 'Badgers' were finally phased out only in 1965.

The 199th OGDRAP based at Nezhin in the Ukraine and commanded by Guards Colonel A S Yerokhin began training in July 1964 and completed conversion to the Tu-22R by early 1967. The 121st ODRAP at Machulischchi airbase near Minsk operated the recce version briefly in 1965-66. It was soon assigned to the heavy bombing role, becoming the 121st DBAP, re-equipping with Tu-22KDs and '22PDs, passing on the Tu-22Rs to Zyabrovka and Nezhin.

The Aviatsiya Voyenno-Morskovo Flota (Naval air arm – AV-MF) started taking delivery at the same time, with the Baltic Fleet's 15th DRAP at Chkalovskoye airbase near Kaliningrad, also a previous Tu-16R operator, as the first naval unit to fly the type. The Black Sea Fleet followed suit – its Tu-22Rs went to the recce unit at Saki airbase in the Crimea.

The heavy bomber units began re-equipping in 1965, with two Tu-22KD squadrons and one Tu-22P and 'PD squadron to a regiment. Each squadron usually had 10 to 12 aircraft, later augmented by a pair of Tu-22U and/or 'UD crew trainers. The 203rd DBAP did become the first DA unit to fly the Tu-22 after all, receiving its Tu-22RDs and 'PDs in 1965 – its own aircraft this time. The 121st DBAP came next, followed in 1968 by the 341st DBAP at Ozyornoye airbase near Zhitomir.

The Far East Defence District, on the other hand, was left out when it came to re-equipment. A handful of crews from Vozdvizhenka airbase under Squadron Leader V V Gonchenko took their training at Kazan and proudly flew five Tu-22s back home. But in the late 1960s the top brass in Moscow decided it was more efficient to keep the type on the European theatre of operations, and the bombers were taken away, forcing the Far East to make do with old Tu-16s.

By late 1967 the Tu-22 was fully operational, with 145 aircraft in service with the DA and 57 with the AV-MF. Tu-22s served alongside 'Badgers' rather than replacing them completely; in fact, both types were to soldier on side-by-side into the early 1990s.

during high speed low level sorties – and that meant the extra stress and strain on the airframe as well as battle damage. Iraqi Tu-22Bs were repeatedly used with great success for penetrating Iranian air defences in such missions. In January 1984, VVS Tu-22R f/n 3201 reached 1,000km/h (621mph) at 150m (492ft), exceeding all possible limits – and came home none the worse for wear.

Tu-22 crews averaged up to 100 flying hours per year; each crew had to log at least two hours of supersonic flying annually. Usually the Tu-22 cruised below Mach 1, making only a ten minute supersonic dash to or over the target; this included 60° rolls and bomb drops or missile launches.

To avoid angering law-abiding citizens, supersonic flying was restricted to high altitude and sparsely-populated areas. Shock waves produced by high flying supersonic aircraft generally die down before reaching the surface. In the early 1970s, there must have been some sort of atmospheric anomaly when a Nezhin-based 'R overflew the city of Soomy at 11,000m (36,089ft) it created a tremendous sonic boom that shattered windows all over town. Soomy looked like a war zone!

For structural integrity reasons the Tu-22 was not allowed to go supersonic at low altitude; however, low level flights at speeds pretty close to Mach 1 were standard operational procedure. These sorties placed an enormous physical and psychological strain on the pilots since the Tu-22 is not equipped for automatic terrain following like, for example, the Rockwell International B-1B Lancer. The result was sometimes tragic; for instance in April 1978 a Tu-22R flew into high ground at the Polesskoye training range during a low level dash.

'Blinder' units were assigned specific targets. In the event of war, Tu-22Ks supported by Tu-22P ECM aircraft were to take out NATO bases in Europe and US Navy Sixth Fleet warships. In anti-shipping strike missions the bombers were to reach the Mediterranean flying over the Balkan peninsula. Anti-shipping strike training was performed at a missile range in the north eastern part of the Caspian Sea, using decommissioned warships as targets.

The Tu-22Rs were to reconnoitre NATO air defences, command, control, communications and intelligence facilities and other land targets, track enemy warships and supply convoys, and perform damage assessment. The 199th OGDRAP at Nezhin was tasked with strategic reconnaissance in the West European theatre of operations (TO - West Germany and Austria), South Western TO (Greece, the Bosporus and the Marmara Sea) and Southern TO (the Black Sea, Turkey and Iran). The 290th OGDRAP at Zyabrovka covered the Baltic Sea, the North-Western TO and even 'went around the corner' (this was Soviet AF pilots' slang for rounding the Kola peninsula in the north to fly sorties above the Polar Sea and Atlantic). The two units also flew training sorties in an easterly direction towards the Volga river and the Caspian Sea; geographically they were a sort of a 'mirror image' of 'the real thing'.

Baltic Fleet and Black Sea Fleet Tu-22Rs had similar tasks. Even in peacetime, training sorties over international waters were fraught with considerable danger and the 'Blinders' were frequently intercepted by inquisitive NATO fighters. The fact that a crew could earn medals for just 20 'live' reconnaissance sorties and/or flights over international waters spoke a lot for the risk involved.

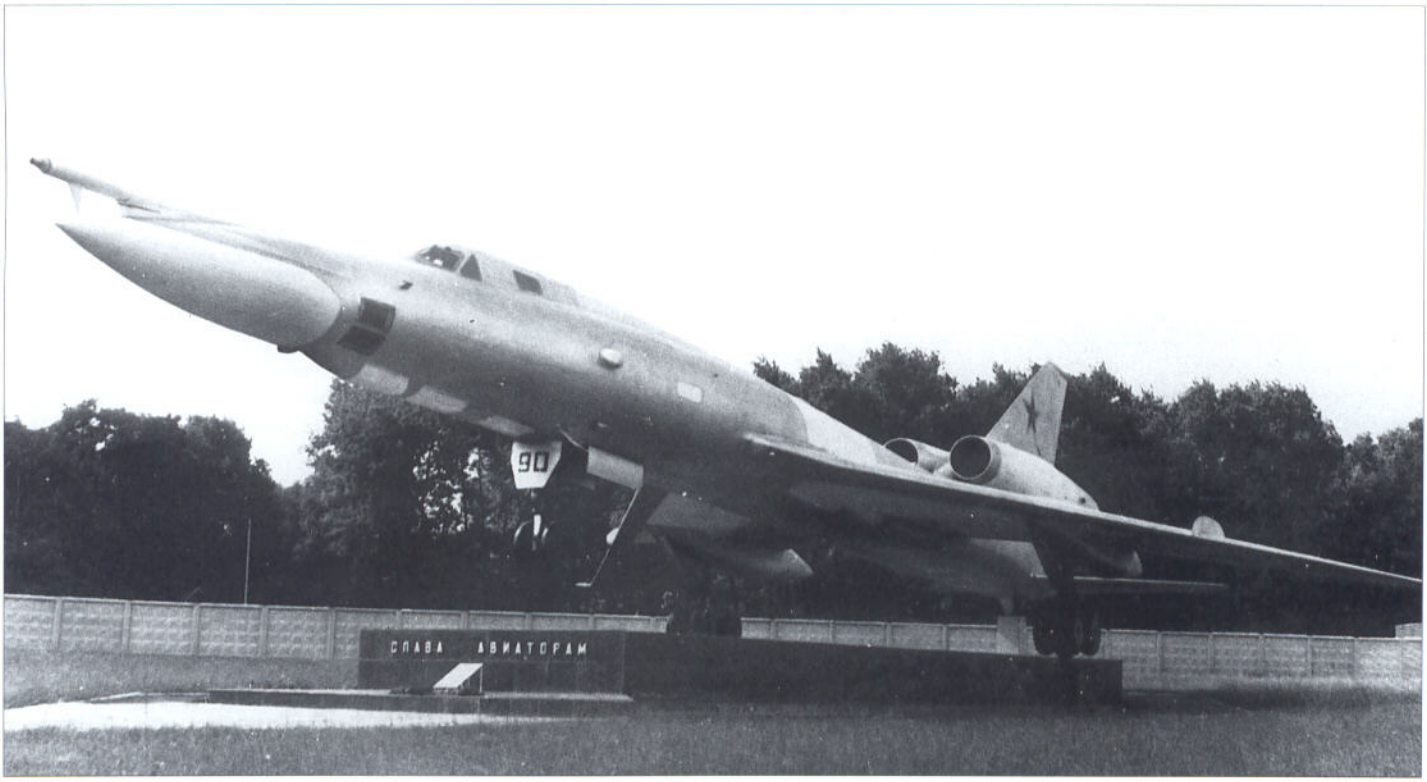
Missile strikes against carrier groups were considered the toughest and most dangerous of the wartime missions. Such a mission involved at least four Tu-22Rs, up to a regiment of Tu-22Ks and one or two squadrons of escort fighters. The 'Rs came first, identifying the aircraft carrier in the group and advise the strike group of its exact location. As they approached the target, two aircraft stayed at high altitude, jamming enemy radars and relaying intelligence until the strike group (including specialised ECM aircraft) came up.

The other two descended and pressed on towards the target, skimming the sea at 100m (328ft) and trying to get within visual range of the target (10 to 15km – 6.2 to 9.3sm). On sighting the carrier they radioed its co-ordinates to the missile carriers which launched active radar homing Kh-22 missiles at 300km (186sm) range. Then things would get really ugly for the Tu-22Rs, as they had to dodge anti-aircraft gunfire and missiles, not to mention the carrier's own fighters. If the incoming Kh-22 missiles had nuclear warheads, getting far enough before the blast became a major problem. In a nutshell, it was very long odds for the Tu-22R crews.

In peacetime the mission was limited to detecting NATO ships, photographing them and tracking their movements. NATO fighters scrambling to intercept the snoopers went to

Opposite page: **A pair of Tu-22KDs carrying Kh-22 anti-shipping missiles.**

Below: **A Tu-22KPD erected as a monument to 'Blinder' crews.** Both Yefim Gordon archive



great lengths to drive the Russians off. Often the fighter placed itself squarely under the 'Blinder's' camera ports to block the view; when the film was developed the result was pure frustration - excellent shots of the fighter's topside, but no warships. Sometimes the fighters would make dangerous manoeuvres, risking a mid-air collision (which would have triggered a major scandal for someone to draw political dividends from). Watching single warships was easier; usually the Black Sea Fleet aircraft did that, tracking US Navy ships calling at Turkish ports.

A typical tactic used by the Tu-22R was known as the 'pin-prick technique'. This meant heading straight for the border and 'harassing' the air defences, provoking them into revealing themselves. Having caused a regular ballyhoo and recorded radar and command radio frequencies, the 'ferret' aircraft made a U-turn some 20km (12.4sm) from the border and made for home.

Tu-22Rs were also used to 'harass' Soviet air defences to make sure they worked efficiently. On one occasion in the late 1980s, a group of 'Blinders' staged a major 'NATO air raid from bases in Turkey', following 16 predetermined avenues of approach to cover all of the Ukraine. They flew at low level, following rivers and the Black Sea coastline to escape radar detection. The result was shocking. Some aircraft got through unnoticed, others were 'destroyed' but not before they had penetrated deep into Soviet territory and 'done great damage'.

Reprisal was swift: the chiefs of the southern air defence districts were removed. Incidentally, an even more massive change of the USSR's military leadership occurred after Matthias Rust's notorious landing in Moscow's Red Square in a light aircraft. There was even a joke that Rust ought to have been given a medal by the Soviet government for strengthening the Soviet defences within the shortest possible time!

More difficult tasks facing 'R crews included checking the tactical camouflage of friendly forces, the observability of camouflaged intercontinental ballistic missile (ICBM) launch control centres and other military installations. For example, they searched for RS-12 'Topol' ICBMs on wheeled transporter/launcher vehicles in the Ukraine and Belorussia and for 'Hell's Train' ICBM launchers disguised as boxcars in the suburbs of Moscow.

Afghanistan Action

Soviet Air Force 'Blinders' saw action during the closing stage of the Afghan war. Four 341st TBAP Tu-22PDs were detached to Maryy-2 (pronounced like 'Marie') airbase in Tadjikistan near the Afghan border in October 1988. They were to provide ECM support for Tu-22M3 'Backfire-C' bombers from Poltava in the Ukraine. The 'Backfires' operating out of Maryy flew bomb strike missions against Mujahideen rebels in the areas adjacent to the Afghan-Pakistani border, including Khost province. Pakistani Air Force General Dynamics F-16A Fighting Falcons were becoming increasingly active in the area and Raytheon Hawk surface-to-air missiles were also considered a distinct threat, forcing the VVS to take preventive steps.

In early December the Tu-22M3s went back to Poltava and were replaced by another 'Backfire-C' regiment deployed from Orsha. The 'Blinders' stayed until January 1989 when they, too, were replaced by four sister ships from the 203rd TBAP. By then the fighting had largely moved to areas within the country, notably the Salang pass. Mujahideen air defences were not so sophisticated there and ECM support was no longer a priority task, so the Tu-22PDs returned home by February.

The 199th ODRAP was due to fly missions in Afghanistan. On 3rd November 1988 three of its Tu-22Rs were transferred from Nezhin to Mozdok in the then Checheno-Ingush Autonomous

Republic (southern Russia). A week later, however, they returned to Nezhin without making a single combat sortie.

Middle Eastern 'Blinders'

As mentioned earlier, two of the Soviet Union's Middle East allies, Iraq and Libya were the only foreign operators of the 'Blinder' (in its Tu-22B and Tu-22UD forms). Saddam Hussein and Colonel Muammar Qaddafi planned to use them in a future war against their everlasting and bitter enemy, Israel. The plan never materialised, but the Tu-22s did see action in wars against Iraq's and Libya's Islamic neighbours.

Crew training took place at Zyabrovka airbase. The Iraqi pilots took their training first (in 1973-74) under the supervision of Major General V S Shookshin. Soviet qualified flying instructors (QFIs) recalled that the trainees took the practical part very earnestly but displayed a total lack of interest for the theoretical course.

The language barrier was no problem since the Iraqis had taken their initial flight training in the USSR and spoke Russian fairly well. Upon completion of the training course the Iraqis picked the best of the unit's Tu-22Rs which they flew home after the aircraft had been converted to Tu-22B standard. The Libyans followed suit in 1976.

Training did not always run smoothly. One trainee pilot was killed in the crash of a Tu-22U; the QFI and Russian navigator ejected safely but for some reason the Arab trainee never even tried to eject. Iraqi and Libyan crews continued proficiency training at Zyabrovka even after delivery of the aircraft.

Generally the Arabs were capable pilots who could master even such a demanding aircraft as the Tu-22. In May 1984 Tu-22R f/n 702 suffered a critical failure shortly after taking off on a training flight from Zyabrovka. The navigator and gunner/radio operator ejected but the Arab pilot managed to land with a landing weight of 72,000kg (158,730lb) - well above the normal weight of 56,000kg (123,456lb). The aircraft was subjected to 4.5g but stayed in one piece.

Conversely, in the same month an Arab trainee on Tu-22U f/n 5001 exceeded the speed limit in a dive and suffered g-loc (g-induced loss of consciousness) when trying to pull out of the dive. Luckily the instructor (who, incidentally, was not a QFI but a navigator) remained conscious and took over, pulling the aircraft into straight and level flight at 4,000m (13,123ft) and landing safely.

Iraqi pilots were quick to master the low level flying technique and put it to good use during the Iran-Iraq war. After delivery, special reference lines were applied to the navigator's glazing of Iraqi Tu-22Bs to make them better suited for ultra-low level sorties.

The first known case when the Tu-22B was used operationally dates back to 1978 when a two-year war broke out between Tanzania and Uganda. Seeing that he was losing the war, the Ugandan dictator Idi Amin turned to Libya for help. Qaddafi responded immediately, sending a pair of 'Blinders' to make a bombing raid on the Tanzanian city of Mwanza on the night of 30th March 1979. Luckily there were no victims among civilians.

The main theatre of operations for Libyan 'Blinders', was the long and bloody civil war in Chad. Gamalee Wadday's pro-Libyan rebels were fighting the regime of Hissen Habre backed by France and the US. The government forces lacked an effective air defence and Libyan Tu-22Bs could hit any target within Chad with impunity. For example, on 9th October 1980 a group of 'Blinders' bombed government troops near the Chadian capital of N'djamena, allowing Wadday to seize the city and win a temporary victory.

However, Habre was not put off all that easily, and hostilities resumed a year later. Libyan Tu-22Bs came into the picture again in July 1983. Between July and September they flew a number of sorties against Habre's troops near Fadah, Faya-Larjo and Umm Shalouba.

After a short period of relative peace and quiet, war flared up again in early 1986. On 17th February a solitary Tu-22B took off from Sebha airbase in Libya and put in an appearance at N'djamena International Airport at 7am, dropping three 500kg (1,102lb) high explosive bombs. One of them fell squarely on the runway, making a crater 20m (65ft) wide and 8m (26ft) deep; the airport had to be closed for 36 hours. Once again, the bomber got away unscathed. As an excuse for being caught off guard, the French air defence forces protecting N'djamena claimed that the bomber had either used a civil airway, pretending to be an airliner, or followed a wadi (dry river bed) at ultra-low level, climbing to 3,000 to 5,000m (9,842 to 16,404ft) immediately before the attack.

Tu-22Bs supported the Libyan army offensive in northern Chad near the Tibesti plateau in October 1986 to March 1987. In March Habre's troops launched a counter-offensive, seizing the Libyan Arab Republic Air Force base Ouadi-Doum in northern Chad. The assorted aircraft captured there included two 'Blinders'. Infuriated by this setback, Qaddafi ordered an air raid on Ouadi-Doum to destroy the aircraft and prevent them from falling into enemy hands, but the effect was minimal.

More frustration arose on 8th August when Chadian forces overran Auzu, a Libyan Air Force base in the territory disputed by Chad and Libya. Libyan forces made several counter-attacks, including bombing raids by Tu-22Bs. One of the bombers was shot down by a shoulder-launched surface-to-air missile (SAM); some sources claim it was a Soviet-made S-175 'Koob' (ASCC SA-3 'Ganef') SAM battery captured from the Libyans.

On 5th September Chadian forces entered Libyan territory, knocking out Maaten-as-Sarah airbase. Qaddafi retaliated by ordering another attack on N'djamena on 6th September. This time, however, the French Army's 405th missile regiment was ready for action. One of the two bombers was shot down with a Hawk missile, with the loss of the entire crew; the other Tu-22 dumped its bombs hastily and fled. More air raids on Ouadi-Doum, Fadah and Faya-Larjo were the Tu-22B's final contribution to the failed Chadian campaign.

Qaddafi had 'ideological differences' with another African dictator - the Sudanese General J Nimeiri who had supported Habre during the war. Quite simply, Nimeiri had supported the wrong side and needed disciplining. So around 15th August 1984 a Libyan Tu-22B bombed Omdurman, killing five civilians and injuring dozens more. In 1985 Nimeiri was unseated in a *coup d'état* and the new government was decidedly pro-Libyan. Western sources state that in March 1986 the Sudanese government borrowed several 'Blinders' to make raids against Nimeiri's supporters who had holed up in southern Sudan.

Six surviving Tu-22Bs were still on strength in 1995. However, they were very probably unserviceable because spares supplies had been cut off due to United Nations sanctions. These were imposed when Libyan terrorists blew up PanAm Boeing 747-121A N739PA *Clipper Maid of the Seas* over Lockerbie, Scotland, in 1988.

Iraqi Air Force Tu-22Bs were in action from the outset of the eight year war with Iran which started on 19th September 1980. The combat radius was great enough to hit any target in Iran, and sorties were flown day and night.

Soviet military advisors in Iraq recalled that the discipline of Saddam's airmen was unyielding. One of 'our men in Baghdad' once witnessed the methods used to keep up the fighting spirit. As the first targets in Iran were designated during a mission briefing, one of the pilots protested, saying he was not about to go killing brother Moslems. Secret service officers immediately took the dissenter to the back of the aircraft parking ramp and shot him there and then. Nobody questioned the rightness of the war anymore.

Military and industrial installations in Tehran and Isfahan were the prime targets of the 'Blinders'. On 23rd September Tu-22s bombed Tehran International Airport - Iran claimed one bomber shot down. About a week later, a large group of Tu-22Bs escorted by fighters knocked out two major automobile assembly plants near the airport.

For a short while in the opening stages of the war, IAF Tu-22Bs operated from bases in Saudi Arabia and North Yemen. This arrangement, which Saddam Hussein had negotiated with the two countries, kept the valuable (and costly) bombers safe from being destroyed on the ground by Iranian air raids. Since early 1981 the Tu-22s were used only sporadically to minimise wear and tear on them, since the Soviet Union had embargoed all further arms supplies to Iraq. The embargo remained in force, even though Saddam Hussein repeatedly asked the Soviet government for more Tu-22s.

In 1982 Iraqi Tu-22Bs hit several major targets deep within Iran, primarily large concentrations of troops and oil refineries. Iran claimed

the destruction of two bombers that year, but this should be viewed with scepticism. Official kill statistics in any war are notoriously optimistic, and if Iraqi and Iranian reports were to be believed it appeared that the entire air forces of both nations had been destroyed several times over!

In May 1985 IAF 'Blinders' resumed strikes against Tehran, Isfahan, Shiraz and other Iranian cities and the oil tanker terminal on Kharg Island. In 16 days of late May and early June alone, 23 raids against Teheran were carried out. In retaliation, Iran bombarded Baghdad with ballistic missiles and made several air raids against the city. This was the beginning of the 'War of the Cities', as the methodical flattening of each other's principal cities came to be known; it continued on and off until hostilities ceased in 1988.

As Iran strengthened its air defences Iraqi pilots discovered that the Tu-22 could absorb a lot of battle damage. On one occasion a missile fired by an Islamic Iranian Air Force McDonnell F-4D Phantom II took off half the horizontal tail. The pilot felt a jolt and noted a deterioration in pitch control but managed to make it home and land safely. In another case a Hawk missile detonated under a Tu-22, causing severe shrapnel damage to the lower fuselage, but again the aircraft made it back to base. (The Hawk has a proximity fuse and does not need to score a bull's eye to do the job.)

On 19th May 1988 the Tu-22B joined the 'tanker war' when IAF 'Blinders' sent two Iranian supertankers up in flames. These were the *Awai* displacing 316,379 tons and the *Sanandai* displacing 253,837 tons; more than 50 crewmen on both ships died in the blaze.

Five IAF Tu-22Bs remained when Iran and Iraq entered a truce in late 1988. US media claimed all five destroyed on the ground by Allied air strikes during Operation 'Desert Storm'; however, Western aerospace magazines (notably *Flight International*) stated that four were still in service in 1995. In early 1996 Iraq claimed that the surviving Tu-22s had been restored to operational status (suggesting that they were damaged during the Gulf War).

Twilight

The only Tu-22s remaining in service as of 1997 were the Ukrainian ones. Ukrainian AF 'Rs, 'Ks and 'Ps are flown by highly skilled airmen with a lot of flight hours behind them. Most of the 199th ODRAP's pilots and navigators had the First Class skill level (the highest level in the former Soviet Air Force) when the Ukraine got its own air force. As with all of the CIS states, the Ukraine air force is 'running on empty', with fuel shortages and lack of spares causing a drastic fall-off in the number of sorties. Yet the Ukraine somehow manages to hold the line, the 'Blinder' units demonstrating high combat readiness and still flying recce sorties over the Black Sea.

Tu-22Rs were also used a lot for civilian needs – that is, for photographic duties by request of various civilian agencies. This included damage assessment in the event of forest fires, earthquakes and other natural disasters; the pictures were processed immediately and supplied to civil defence authorities for damage control. Other uses included mapmaking and geodetic surveying. For the Ukrainian Air Force this was a way to earn urgently-needed cash.

Tu-22KPD in a static display at Poltava.

From 'Blinder' to 'Backfire'

Dramatic view of a Tu-22M1 on take-off. The evolution that turned the 'Blinder' into 'Backfire' had only the designation Tu-22 in common when the final product emerged.
Yefim Gordon archive

The original plan was for the Tu-22 to replace bomber, missile carrier, active/passive ECM and Photint/Elint versions of the earlier subsonic Tu-16 'Badger' in service with the VVS DA and AV-MF. In reality, the Tu-22 complemented the Tu-16 rather than replaced it.

There were several reasons for this. The 'Blinder' was not all that superior in performance to the Tu-16. Its supersonic capability was all but non-existent, since missions were flown in subsonic mode most of the way (at a speed very close to the Tu-16's cruising speed) with only a brief supersonic dash over the target. 'Ol' Man Badger' was not about to retire so fast - constant upgrades and more capable weapons eg, the KSR-5 and KSR-5P (ASCC AS-6 'Kingfish') missiles of the Tu-16K-26 'Badger-G Mod' made the Tu-16 a potent weapon even in the 1970s.

Huge numbers of Tu-16s – no less than 1,631 had been built by three factories (No.18 at Kuybyshev, No.22 at Kazan and No.64 at Voronezh) – could not possibly be replaced by the relatively few Tu-22s.

As well as these, a new approach to supersonic heavy bomber design was needed to get a real Tu-16 replacement. Unfortunately, the Soviet leader, Nikita S Khruschchov, had a bias towards intercontinental ballistic missiles (ICBMs), much to the detriment of Soviet military aircraft development. Many promising designs were killed off because of this unreasoning attitude. Tupolev decided to go for broke, stating at a Government session that the Tu-22 could be developed to suit all needs of

the heavy bomber arm of the VVS. The gamble paid off; the government let the Tupolev OKB pursue its own course, tasking it with only a small amount of work on unmanned aerial vehicles (UAVs).

Development work on new long range supersonic bombers proceeded in several directions. A series of projects resulted.

Model 106 (Tu-106)
Long range supersonic bomber

One of the early ideas was to make the basic Tu-22 cleaner aerodynamically, giving it a better powerplant, more powerful weapons and more capable avionics. When the initial Tu-105 and the Tu-105A were still on the drawing board, there was a proposal to fit Kuznetsov NK-6 engines to the bomber. The idea was floated several times but each time the engineers rejected it, knowing that it was highly unlikely that Mach 2 could be squeezed out of a Mach 1.5 aircraft merely by putting in bigger engines. More radical changes were needed if performance was to be really improved.

In the early 1960s Tupolev designers produced a thoroughly revamped version of the Tu-22 under the project designation Model 106. New features were mainly the powerplant and new wings swept back 60° at quarter-chord rather than 52°14'30". The wings were also thinner, with an average thickness-to-chord ratio of 3.5% instead of 6%; they were to provide a lift/drag ratio of 4.5 at a cruising speed of 1,800km/h (1,118mph). Initially, though, the wings were identical to those of the Tu-105A.

Two NK-6s were housed in a boxy-looking common nacelle with a V-shaped front end, similar to the underwing nacelles of the later Tu-160 'Blackjack'. The vertical splitter dividing the supersonic air intake into port and starboard engine ducts incorporated variable ramps.

Three basic versions were envisaged: bomber/missile strike (Tu-106B and Tu-106K) and a reconnaissance platform. Range was estimated at 2,800 to 3,000km (1,739 to 1,864 sm). Unlike the Tu-22, the new bomber lacked defensive armament from the outset; a 'Siren' ECM pack replaced the gun barbette.

Work on the Tu-106 progressed far enough for a static test article to be built; this represented the aft fuselage and engine nacelle only since the rest of the airframe remained unchanged. Concurrently, the ECM pack was put through its paces on a production Tu-22P converted into an avionics test-bed. However, the design team soon realised that the single-mode Tu-106 offered little advantage over the Tu-22 and the programme was terminated.

Model 106A (Tu-106A)
Long range bomber/missile strike aircraft

A more radical redesign of the Tu-22, designated Tu-106A, featured a T-tail plus new wings and engines. Four powerplants were considered: two NK-6 afterburning turbofans in underwing nacelles, four Tumanskiy R-15B-300 or Dobrynin VD-19R2 afterburning turbojets paired in underwing nacelles, or three R-15Bs. The latter configuration was the most unusual; two of the engines were mounted under the wings and the third at the base of the fin, with a 'straight-through' mounting *à la* McDonnell Douglas DC-10 wide-body airliner.

The Kuznetsov-powered version had a 97 ton (213,844lb) take-off weight (TOW). Range when cruising at 950km/h (590mph) was 6,000km (3,728sm) at high altitude or 3,500km (2,174sm) at 300m (984ft). Top speed was set at 2,500km/h (1,553mph) and the take-off run at 1,800 to 2,100m (5,905 to 6,889ft).

With four Tumanskiy engines the aircraft had a 99.7 ton (219,797lb) TOW, a range of 4,500 km (2,796sm) at a cruising speed of 950km/h (590mph), a top speed of 2,500km/h (1,553 mph) and a take-off run of 1,500 to 1,800m (4,921 to 5,905ft). With three engines it was 98 ton (216,049lb), 5,000km (3,106sm), 2,500 km/h (1,5553mph) and 1,800 to 2,100m (4,921 to 5,905ft) respectively.

The Dobrynin-powered version grossed at 99 ton (218,253lb). Range was 5,500km (3,417 sm) when cruising at 950km/h or 4,500 to 5,000km (2,796 to 3,106sm) when cruising at 2,100km/h (1,304mph). Once again, top speed was 2,500km/h (1,5553mph) and take-off run 1,600 to 1,900m (5,249 to 6,233ft).

The Tu-106A had an overall length of 38.75m (127ft 1.6in) with NK-6 or VD-19R2 engines, 38.95m (127ft 9.4in) with three R-15B-300s or 38.76m (127ft 2in) with four R-15B-300s. Wing span was 23.666m (77ft 7.73in) and wing area 190m² (2,043ft²).

Offensive armament consisted of one Kh-22 ASM carried semi-recessed in the fuselage. There was no defensive armament.

Model 106K (Tu-106K)
Long range bomber/missile strike aircraft

The Tu-106K was a missile carrier version of the Tu-106 as described above, with two aft-mounted NK-6s and standard Tu-22 wings. The aircraft was armed with a single Kh-22 ASM and lacked defensive armament (an ECM pack was mounted in the tail).

The Tu-106K was 40.195m (131ft 10.48in) long, 10.9m (35ft 9.13in) high and had a wing span of 23.64m (77ft 6.9in). Top speed was limited to 2,200km/h (1,367mph) and supersonic cruise was 1,500 to 1,800km/h (932 to 1,118 mph). Range without external stores was 3,500km (2,174sm) at 950km/h (590mph) or 3,000km (1,864sm) in supersonic cruise. Combat radius was 3,500km (2,174sm) subsonic or 1,750 to 2,000km (1,087 to 1,242sm) in supersonic cruise. Service ceiling was 16,000 to 18,000m (52,493 to 59,055ft) and take-off run was 1,800 to 2,000m (5,905 to 6,561ft).

Model 106B (Tu-106B) Long range bomber/missile strike aircraft

The Tu-106B represented Stage 2 of the 'Blinder's' evolution programme, differing from the Tu-106K in having new thin wings swept back 60° at quarter chord as described earlier. The armament and systems remained unchanged.

The Tu-106B was 40.4m (132ft 6.5in) long, 10.75m (35ft 3.2in) high, had a 23.66m (77ft 7.7in) wing span and a 9.0m (29ft 6.3in) landing gear wheel base.

Model 125 (Tu-125)
Long range bomber/missile strike aircraft

This development direction resulted in an aircraft that no longer had anything in common with the Tu-22. The Tu-125 was designed to travel 4,500 to 4,800km (2,796 to 2,982sm), cruising at up to 2,500km/h (1.553mph). Its armament was a single missile with a launch weight of 3.5 to 4 ton (7,716 to 8,818lb), including a 900kg (1,984lb) warhead, and a range of 500 to 600km (310 to 372sm). It was to make large scale use of titanium and feature state-of-the-art avionics and mission equipment.

Unlike earlier projects, the Tu-125 utilised a tail-first (canard) layout. Two versions were proposed, powered by two Kuznetsov NK-6B or four Tumanskiy R-15B-300 turbojets respectively; the engines were housed (singly or in pairs) in underwing nacelles with supersonic intakes featuring vertical intake ramps.

Tupolev engineers succeeded in obtaining a lift/drag ratio of 6.0 at Mach 2. The Kuznetsov and Tumanskiy bureaux promised a reduction in specific fuel consumption (SFC) that would have given the bomber adequate range in supersonic cruise. Yet the Tu-125 never materialised - it was just too radical. Besides, the tail-first layout had inherent shortcomings, such as poor directional stability.

Developing and refining an all-new aircraft called for time and money; Soviet aircraft designers were short of both because missile and space programmes swallowed a huge portion of the defence budget. A design bureau unable to offer good and, above all, relatively cheap aircraft could even be eliminated completely, which is exactly what happened to Myasischchev's OKB-23 (which was subsequently reborn).

Model 145 (Tu-145)
Supersonic bomber/missile strike aircraft

By the mid-1960s the Tupolev OKB found themselves in a paradox. Upgrading the Tu-22 with resources available then did not produce the desired long term effect, whereas developing an all-new single-mode aircraft did not give a sizeable improvement in performance over the Tu-22. The situation clearly called for a new approach to heavy bomber design. After doing some research on heavy bomber operations in contemporary warfare the OKB firmly committed itself to developing a multi-mode bomber. Such an aircraft had to be capable of flying 6,000 to 7,000km (3,728 to 4,349sm) subsonic and penetrating enemy defences at ultra-low level or in Mach 2 high altitude flight. Good field performance and hence low approach speed was another requirement. The only answer to these contradictory demands was variable geometry (VG).

From 'Blinder' to 'Backfire'

Dramatic view of a Tu-22M1 on take-off. The evolution that turned the 'Blinder' into 'Backfire' had only the designation Tu-22 in common when the final product emerged.
Yefim Gordon archive

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Model 106 (Tu-106)
Long range supersonic bomber

One of the early ideas was to make the basic Tu-22 cleaner aerodynamically, giving it a better powerplant, more powerful weapons and more capable avionics. When the initial Tu-105 and the Tu-105A were still on the drawing board, there was a proposal to fit Kuznetsov NK-6 engines to the bomber. The idea was floated several times but each time the engineers rejected it, knowing that it was highly unlikely that Mach 2 could be squeezed out of a Mach 1.5 aircraft merely by putting in bigger engines. More radical changes were needed if performance was to be really improved.

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Three basic versions were envisaged: bomber/missile strike (Tu-106B and Tu-106K) and a reconnaissance platform. Range was estimated at 2,800 to 3,000km (1,739 to 1,864 sm). Unlike the Tu-22, the new bomber lacked defensive armament from the outset; a 'Siren' ECM pack replaced the gun barbette.

Work on the Tu-106 progressed far enough for a static test article to be built; this represented the aft fuselage and engine nacelle only since the rest of the airframe remained unchanged. Concurrently, the ECM pack was put through its paces on a production Tu-22P converted into an avionics test-bed. However, the design team soon realised that the single-mode Tu-106 offered little advantage over the Tu-22 and the programme was terminated.

Model 106A (Tu-106A)
Long range bomber/missile strike aircraft

A more radical redesign of the Tu-22, designated Tu-106A, featured a T-tail plus new wings and engines. Four powerplants were considered: two NK-6 afterburning turbofans in underwing nacelles, four Tumanskiy R-15B-300 or Dobrynin VD-19R2 afterburning turbojets paired in underwing nacelles, or three R-15Bs. The latter configuration was the most unusual; two of the engines were mounted under the wings and the third at the base of the fin, with a 'straight-through' mounting *à la* McDonnell Douglas DC-10 wide-body airliner.

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The Tu-106A had an overall length of 38.75m (127ft 1.6in) with NK-6 or VD-19R2 engines, 38.95m (127ft 9.4in) with three R-15B-300s or 38.76m (127ft 2in) with four R-15B-300s. Wing span was 23.666m (77ft 7.73in) and wing area 190m² (2,043ft²).

Offensive armament consisted of one Kh-22 ASM carried semi-recessed in the fuselage. There was no defensive armament.

Model 106K (Tu-106K)
Long range bomber/missile strike aircraft

The Tu-106K was a missile carrier version of the Tu-106 as described above, with two aft-mounted NK-6s and standard Tu-22 wings. The aircraft was armed with a single Kh-22 ASM and lacked defensive armament (an ECM pack was mounted in the tail).

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Model 106B (Tu-106B) Long range bomber/missile strike aircraft

The Tu-106B represented Stage 2 of the 'Blinder's' evolution programme, differing from the Tu-106K in having new thin wings swept back 60° at quarter chord as described earlier. The armament and systems remained unchanged.

The Tu-106B was 40.4m (132ft 6.5in) long, 10.75m (35ft 3.2in) high, had a 23.66m (77ft 7.7in) wing span and a 9.0m (29ft 6.3in) landing gear wheel base.

Model 125 (Tu-125)
Long range bomber/missile strike aircraft

This development direction resulted in an aircraft that no longer had anything in common with the Tu-22. The Tu-125 was designed to travel 4,500 to 4,800km (2,796 to 2,982sm), cruising at up to 2,500km/h (1.553mph). Its armament was a single missile with a launch weight of 3.5 to 4 ton (7,716 to 8,818lb), including a 900kg (1,984lb) warhead, and a range of 500 to 600km (310 to 372sm). It was to make large scale use of titanium and feature state-of-the-art avionics and mission equipment.

Unlike earlier projects, the Tu-125 utilised a tail-first (canard) layout. Two versions were proposed, powered by two Kuznetsov NK-6B or four Tumanskiy R-15B-300 turbojets respectively; the engines were housed (singly or in pairs) in underwing nacelles with supersonic intakes featuring vertical intake ramps.

Tupolev engineers succeeded in obtaining a lift/drag ratio of 6.0 at Mach 2. The Kuznetsov and Tumanskiy bureaux promised a reduction in specific fuel consumption (SFC) that would have given the bomber adequate range in supersonic cruise. Yet the Tu-125 never materialised - it was just too radical. Besides, the tail-first layout had inherent shortcomings, such as poor directional stability.

Developing and refining an all-new aircraft called for time and money; Soviet aircraft designers were short of both because missile and space programmes swallowed a huge portion of the defence budget. A design bureau unable to offer good and, above all, relatively cheap aircraft could even be eliminated completely, which is exactly what happened to Myasischchev's OKB-23 (which was subsequently reborn).

Model 145 (Tu-145)
Supersonic bomber/missile strike aircraft

By the mid-1960s the Tupolev OKB found themselves in a paradox. Upgrading the Tu-22 with resources available then did not produce the desired long term effect, whereas developing an all-new single-mode aircraft did not give a sizeable improvement in performance over the Tu-22. The situation clearly called for a new approach to heavy bomber design. After doing some research on heavy bomber operations in contemporary warfare the OKB firmly committed itself to developing a multi-mode bomber. Such an aircraft had to be capable of flying 6,000 to 7,000km (3,728 to 4,349sm) subsonic and penetrating enemy defences at ultra-low level or in Mach 2 high altitude flight. Good field performance and hence low approach speed was another requirement. The only answer to these contradictory demands was variable geometry (VG).

Tupolev's first VG aircraft project was designated Model 145 (Tu-145). It was conceived in the mid-1960s as a multi-role combat aircraft (though not quite the kind of MRCA that was the Tornado!), building on the two main military aircraft design trends of the 1960s – independence from major bases and versatility.

In overall appearance the aircraft was rather similar to the earlier Model 106, 'B and 'K projects. The main new feature was the VG wings which could be set at 20° sweep back for take-off and landing, 65° for maximum range subsonic cruise and 72° for supersonic cruise.

The powerplant was also new, namely two Kuznetsov NK-144 turbofans rated at 215.7kN (48,500lb st) in full afterburner. These were to give the Tu-145 a top speed of 2,500 to 2,700 km/h (1,553 to 1,677sm) at 14,500m (47,572ft) and 1,100km/h (683mph) at 50 to 100m (164 to 328ft). Range was estimated at 6,000 to 8,000 km (3,728 to 4,971sm) in subsonic cruise and 4,000km (2,485sm) in supersonic cruise. Combat radius was 1,500km (932km) if the mission was flown at ultra-low level and 900km/h (559mph).

The Tu-145 was developed primarily as a missile strike aircraft also capable of delivering free-fall bombs. If the enemy had strong air defences the aircraft was to operate at low altitude, engaging the target with an air-launched cruise missile with a range of up to 100km (62sm). If air defences were sparse (eg, in a naval warfare scenario), it could carry a Kh-22.

At the initial design stage the Tu-145 still had considerable commonalty with the Tu-22, which Tupolev believed would facilitate service entry. However, many of the Tu-22's shortcomings were eliminated, eg the Tu-145 had a crew of four, a co-pilot being added to reduce crew workload during long missions.

The crew section was totally redesigned – the pilot and co-pilot sat side-by-side in a much roomier and more comfortable cockpit, with the navigator/bomb aimer and gunner/radio operator sitting behind them. The cockpit featured new upward firing ejection seats and was accessed via four upward opening doors. Ejection was possible nearly from zero level which, of course, made the crews feel much more comfortable.

The Tu-145 project was not proceeded with in that form, evolving into a new heavy multi-role combat aircraft with variable-sweep wings known in-house as 'Project 45' the Tu-22M 'Backfire' which is described separately.

Model 145P (Tu-145P)
ECM aircraft

When fitted with active/passive ECM equipment in the bomb bay the aircraft was designated Tu-145P (postanovschchik, or pomekh). The mission equipment was catered for by a modified power supply system with alternating current (AC) converters (variable-frequency to constant-frequency) and rectifiers. Besides electronic jammers and chaff dispensers, the aircraft featured infra-red countermeasures (IRCM) flare dispensers.

Model 145 (Tu-145)
Anti-submarine warfare version

A dedicated anti-submarine warfare (ASW) version equipped with sonobuoy launchers and depth charges was developed in parallel with the basic bomber. Given the Tu-145's estimated speed and endurance figures, it could quickly reach the area to be patrolled and have an adequate on-station time.

Model 145R (Tu-145R)
Long range reconnaissance aircraft

The Tu-145's high payload and speed range made it well suited for reconnaissance duties, and a recce version designated Tu-145R was also developed. Intelligence was to be transmitted to ground command, control, communications and intelligence (C³I) centres by data link; this enabled the Tu-145R to act as a target designator for Soviet Army, VVS and Soviet Navy units.

By virtue of its good field performance and six-wheeled main gear bogies suited for rough field operation, the aircraft could use Class II paved runways and tactical dirt strips with a load limit of 8kg/cm² (114lb/in²)

Tu-125 Specification

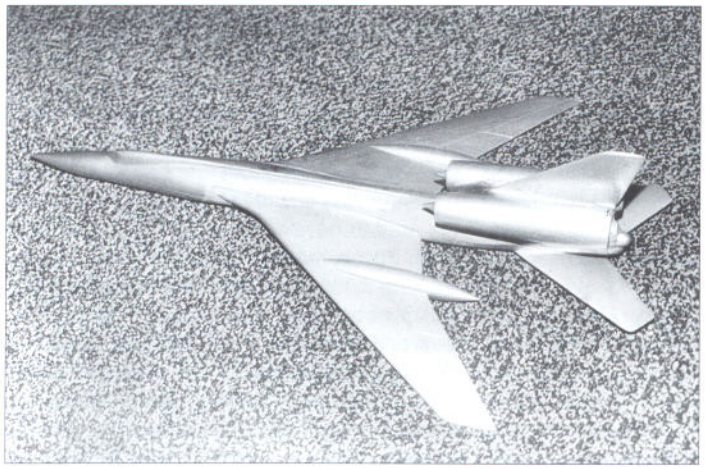
	Version A	Version B
Powerplant	2 x NK-6B	4 x R-15B-300
Take-off weight	100 to 125 tons 220,458 to 275,573lb	110 tons 242,504lb
Range:		
– supersonic	4,800 to 6,000km 2,982 to 3,728sm	4,800km 2,982sm
– subsonic	7,000 to 9,000km 4,349 to 5,592sm	n/a
Cruising speed	2,500 to 2,650km/h 1,553 to 1,646mph	n/a
Service ceiling	18,500 to 20,500m 60,695 to 67,257ft	25,000m 82,020ft
Take-off run	1,700 to 2,800m 5,577 to 9,186ft	1,700m 5,577ft
Length overall	38.4m 125ft 11.8in	41.4m 135ft 10in
Height on ground	10.1m 33ft 1.63in	9.55m 31ft 4in
Wing span	24.7m 81ft 0.44in	24.7m 81ft 0.44in
Wing area	226.0m² 2,430ft²	226.0m² 2,430ft²
Wing aspect ratio	2.18	2.18

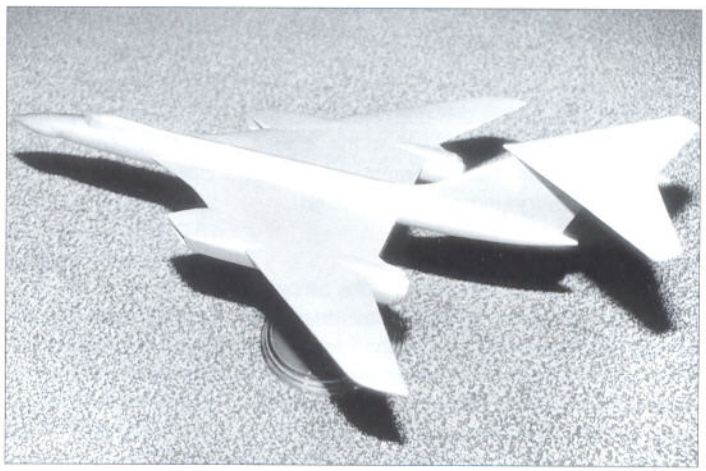
Tu-145 specification

Length	41.0m	134ft 6.17in
Height on ground	9.07m	29ft 9in
Wing span		
– minimum sweep	36.7m	120ft 4.88in
– maximum sweep	23.66m	77ft 7.49in
Maximum take-off weight	105 ton	231,481lb
Top speed	2,200km/h	1,367mph
Unstick speed	280km/h	173.9mph
Range	6,000 to 8,000km	3,728 to 4,971sm
Combat radius	3,000km	1,864sm
Service ceiling	17,000m	55,774ft
Take-off run	1,450m	4,757ft
Armament	one or two Kh-22 ASMs	

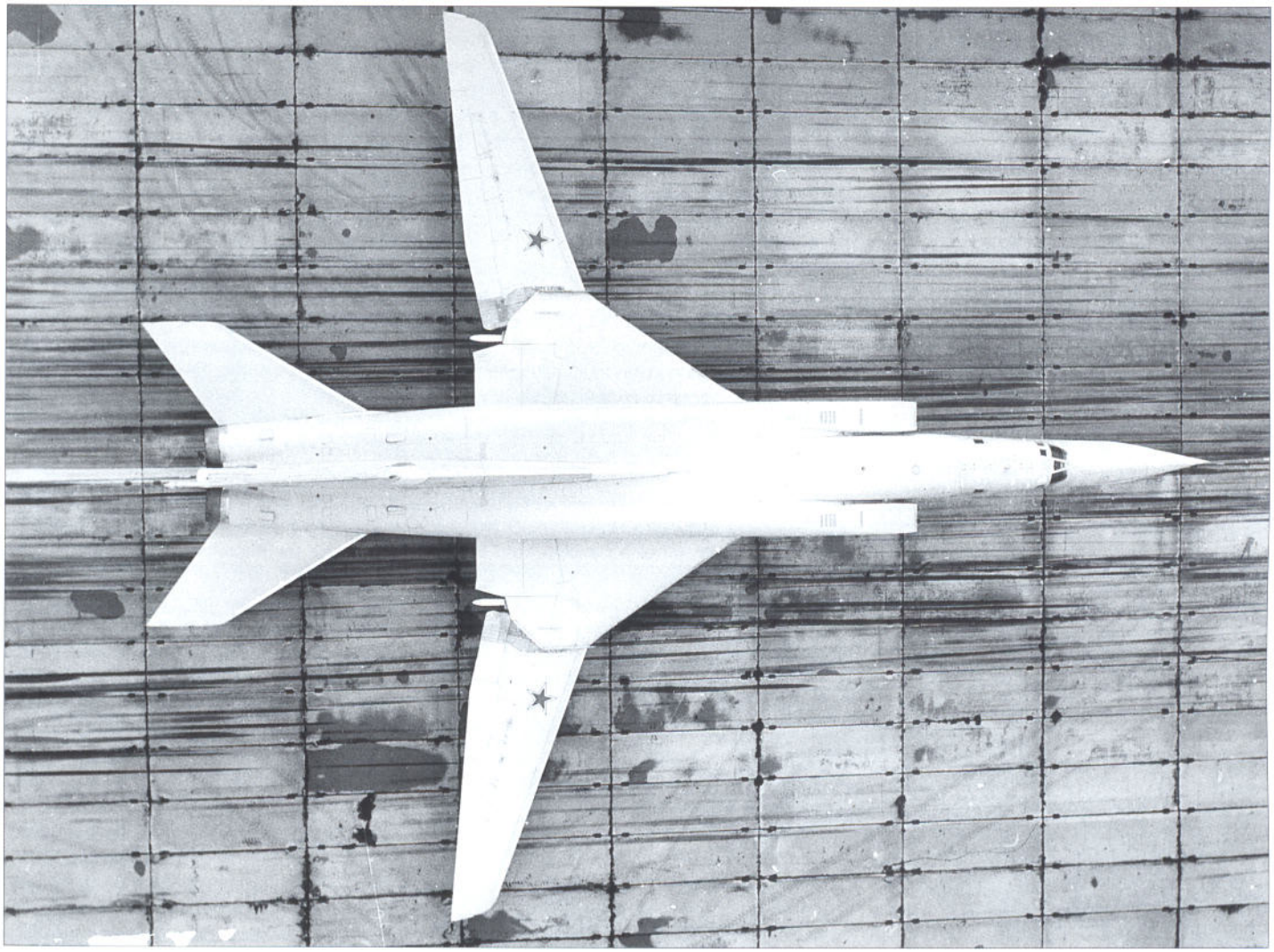
Left: **Model of the Tu-106 showing its obvious relationship to the Tu-22.**

Below: **Tu-106K long range bomber and missile strike aircraft employed modified Tu-22 wings and a similar forward fuselage, but almost everything else was newly designed. It represented a 'half-way house' to the all-new Tu-125 and -145 from which evolved the 'new' Tu-22.** Both Yefim Gordon





'M' for Mis-information



From-above view of a Tu-22M3 with wings in forward sweep. Compare with the similar view of the 'M2 on page 59. Yefim Gordon archive

When Khruschchov, Soviet military aviation's *bête noire*, was unseated in autumn 1964, Soviet design bureaux became very active, pursuing numerous programmes which had been on the back burner 'until tomorrow comes'. The talented fighter designer Pavel Osipovich Sukhoi decided to break new ground with the T-4 (or 'Aircraft 100') strategic bomber, a four-engined compound delta with canards. It looked like a scaled-down Tu-144 supersonic airliner and bore more than a passing resemblance to the Tu-125 project, as did some design studies by Myasischchev. Even Aleksandr Sergeyevich Yakovlev, an even more famous fighter designer, joined the heavy bomber competition; everyone wanted a piece of the action.

The first prototype T-4 ('White 101') entered flight test in August 1972 and flew well but suffered an ignominious fate, the programme being terminated for political reasons after only ten flights. Tupolev was not about to let a young upstart like Sukhoi take his traditional bomber 'market' away from him and offered the VVS a 'massive upgrade to the existing Tu-22'.

Perhaps what really killed the T-4 was its high degree of innovation, high cost and technological difficulties – eg machining titanium, which the entire airframe was made of.

Tupolev's proposal appealed because of its simplicity and low cost – the evolutionary approach. Of course, in terms of performance, Tupolev's contender was no match for the radical T-4. It should be noted that Tupolev had quite a way with military and government leaders, talking them into selecting his designs rather than competitor's aircraft. He received the go ahead and set to work, building on the Tu-145 as a basis for further development.

Version No.2 was rather different from the original Tu-145 project. The engines were buried in the fuselage, which necessitated lateral air intakes with boundary layer splitter plates and long inlet ducts. Originally the aircraft had semi-circular air intakes, *à la* Dassault Mirage; however, these were found to affect stability and control and were superseded by boxy MiG-23 'Flogger'-style intakes (or McDonnell Douglas F-4 Phantom II-style) with vertical intake ramps.

The vertical tail was substantially enlarged and the simple slab stabilisers were replaced by stabilators which could be deflected differentially for roll control. Whether unwittingly or not, Tupolev had misled everyone with that 'massive upgrade' statement. Gradually the Tu-145 evolved into an entirely new aircraft having no structural commonalty with the Tu-22.

The buried engine installation and associated changes (variable intakes, long inlet ducts and new firewalls) incurred a massive weight penalty, increasing take-off weight from 105 tons (231,481lb) to 120 tons (264,550lb). Maximum wing sweep was reduced; the wings now had four sweep settings instead of three, 20°, 30°, 50° and 60°. The armament was identical to the original version of the Tu-145.

The VVS top command's support was decisive in securing the go-ahead; no military equipment could be developed and funded in the USSR unless authorised by a government and/or Communist Party decree. The government found it hard to believe that the Tu-22 bomber, which had just joined the inventory, was so obsolete as to need urgent replacement. To save face and prevent the inter-continental ballistic missile (ICBM) lobby from scoring additional points on a 'screwed-up aircraft programme', the Tupolev OKB made a deal with the VVS, passing the Tu-145 off as a Tu-22 upgrade.

To this end it received the misleading service designation Tu-22M (modifitseerovannyy - modified). To lend more credibility to the story, phoney Tu-22-style factory codes ('Aircraft YuM'/'Aircraft AM') were allocated, along with the OKB code 'Aircraft 45' ostensibly similar to the original 'Model 145' designation. Moreover, Dmitriy S Markov, the Tu-22 project chief, was put in charge of the Tu-22M programme.

This elaborate deception worked and in November 1967 the government issued a decree on the Tu-22M and the K-22M weapons system built around it. The decree specified that the aircraft would be powered by suitably modified NK-144 engines and be armed by a single Kh-22 missile or bombs carried internally – just as proposed by the OKB. The mission equipment fit was identical to the Tu-22K.

The required performance figures were extremely high. The Tu-22M was to have a top speed of 2,300 to 2,500km/h (1,429 to 1,553 mph) and a 7,000km (4,349sm) range with one Kh-22 missile in subsonic cruise. The take-off run was to be no more than 1,600m (5,249ft). Even as the design work progressed the VVS issued a new and much more stringent Specific Operational Requirement (SOR) for weapons. The Kh-22s were increased to three and the ordnance load (bombs or bombs plus missiles) rose to 24 ton (52,910lb).

Because of the many new features and high performance requirements the design work was divided into three stages. During Stage I the Tu-22M would be powered by NK-144-22 engines and have avionics and equipment virtually identical to those of the Tu-22K. Stage II introduced new NK-22 afterburning turbofans (an improved version of the NK-144 rated at 215.7kN - 48,500lb st in full afterburner), an automatic flight control system (AFCS), a new navigation suite and new armament. Finally, performance would be progressively improved during Stage III to meet the VVS requirements.

Like its precursor, the Tu-22M would be built at plant No.22 in Kazan – initially on a small scale. Later, production would increase as the inevitable teething troubles were dealt with and the required performance figures obtained.

The Tu-22M design effort involved many 'firsts' for the OKB, particularly the variable-sweep wings which the entire concept was built around. The location of the wing pivots and the relative areas of the fixed wing glove and movable outer wings were carefully selected so that the aerodynamic pressure centre shifted by no more than 2% mean aerodynamical chord (MAC) as the wings were reset.

The four wing sweep settings were chosen for the variety of flight modes. 20° sweep was used for take-off and landing, 30° for climb out and prolonged subsonic cruise, 50° for air defence penetration in low level transonic flight and 60° for supersonic cruise. The outer wings were actuated by twin hydraulic motors driving screw jacks and powered by separate hydraulic systems for greater reliability.

As the wings moved from maximum to minimum sweep the average thickness-to-chord ratio of the outer wings increased from 6% to 12%, area was increased and aspect ratio almost tripled. This increased lift, ensuring smooth airflow at high angle of attack (AoA) and efficient operation of the high lift devices (leading edge slats and almost full-span double-slotted flaps on the outer wings and slotted flaps on the inner wings). There were no ailerons; for the first time on a heavy bomber, roll control was exercised by spoilers or (at maximum wing sweep) by differential deflection of the stabilators.

The variable-sweep wings fit well into the structural concept of the Tu-22M. The aerodynamical loads generated by the outer wings were transmitted via the wing pivots to the wing glove spars joined to the massive bulkheads and beams flanking the bomb bay. The wing roots accommodated the six-wheel main gear bogies; Tupolev chose to have the main units retract inwards rather than aft, since the traditional main gear fairings did not tie in very well with the VG concept.

Placing the engines in the aft fuselage facilitated maintenance and engine change but created a major problem. The Tu-22M could well hold a Guinness record as the aircraft having the longest-ever inlet ducts, and a good deal of pressure was lost on the way from the intakes to the compressor faces (to say nothing of the weight penalty mentioned earlier). To cure the pressure problem, two large dorsal auxiliary intakes were provided in the upper surfaces of the inlet ducts. Like the translating intake leading edges of the 'Blinder', the intake doors were actuated hydraulically, triggered by landing gear oleo compression and/or flap extension.

Wind tunnel tests at TsAGI showed that the wide fuselage and wing glove 'blanked out' the vertical tail at high alpha (or AoA), impairing directional stability, so the fin was enlarged and a large root fillet added. On the plus side, the fillet provided a convenient location for the TA-6A APU and other equipment.

Long range was a crucial requirement, so the designers went to great lengths to maximise the internal fuel capacity. In addition to bag tanks and integral tanks in the fuselage, fuel was carried in inner and outer wing integral tanks and the base of the fin. Besides, the Tu-22M had flight refuelling capability, featuring a PT-1 fixed refuelling boom borrowed directly from the 'Blinder'.

The KT-1 ejection seats were developed in-house and permitted ejection throughout the altitude envelope and at speeds down to 130km/h (80mph). On the Tu-22, ejection was impossible below 250 to 300m (820 to 984ft).

Tu-22M0 bomber/missile strike prototypes (Izdelye 45-00)

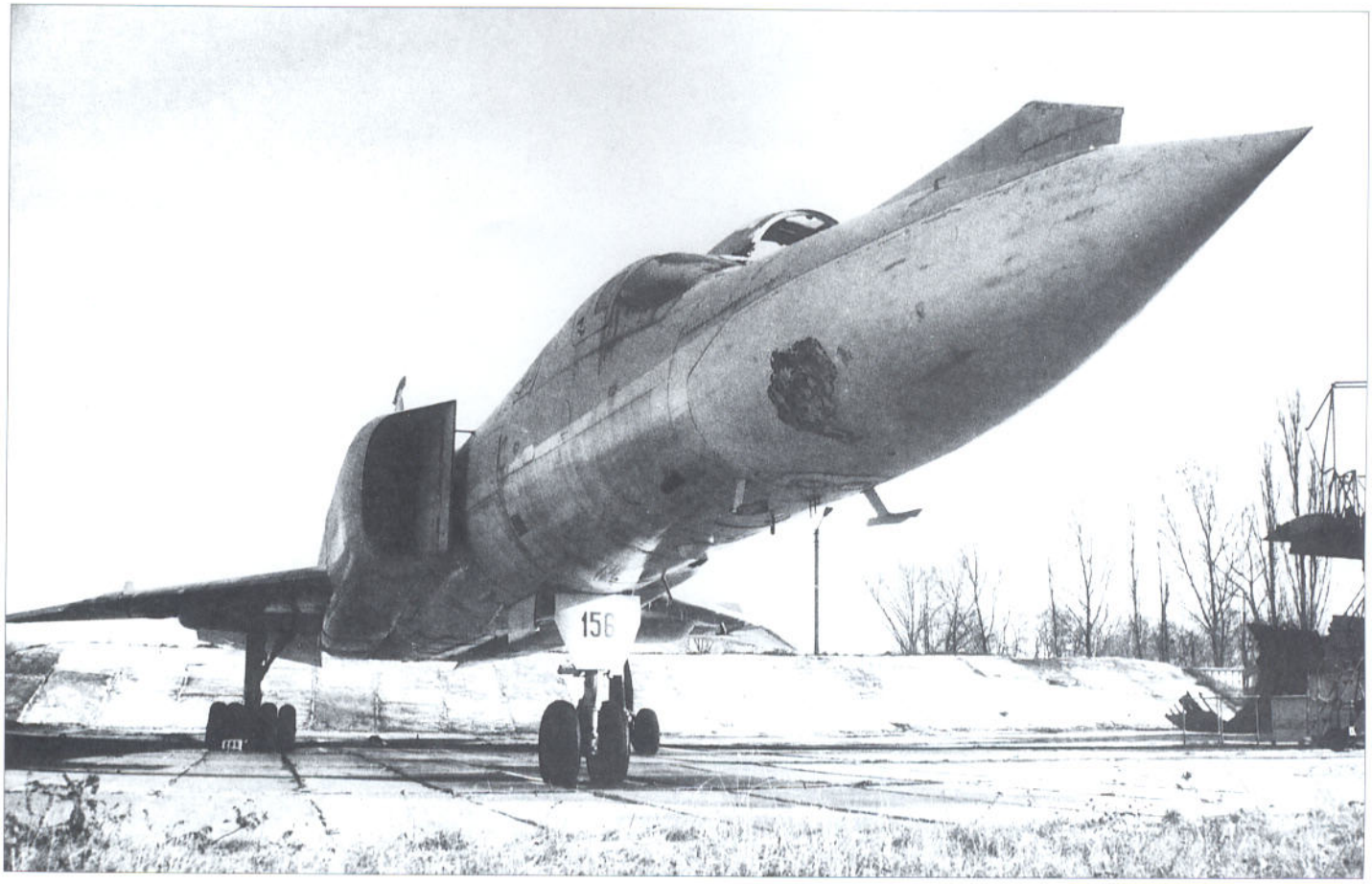
The first prototype Tu-22M was completed by June 1969. In official documents the aircraft was initially referred to as 'Tu-22KM' to support the 'Blinder upgrade' cover story. The actual designation was Tu-22M0 or Izdelye 45-00; hence the aircraft was known in-house as 'Noolyovka' (or 'Aircraft Zilch'). On 30th August Tu-22M0 No.1 became airborne for the first time flown by Tupolev test pilot V P Borisov.

Nine prototypes were built, plus a static test airframe. Between September 1969 and February 1970 they participated in the factory trials programme. Six of the flight test aircraft were set aside for performance and handling tests while the others served for powerplant, systems and weapons testing, including bomb drops and missile launches.

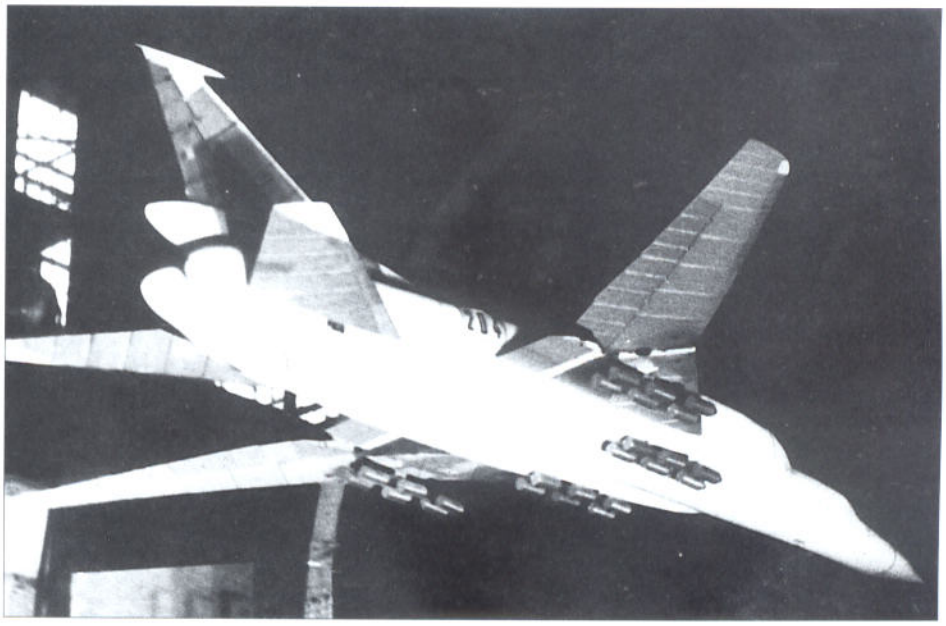
In February 1973 two Tu-22M0s were delivered to the DA's 42nd Combat Training Centre at Dyaghilevo airbase near Ryazan for conversion training. VVS pilots were amazed by the unconventional lines of the 'Noolyovka' with its squat businesslike appearance, flattened fuselage and 'swing wings'. The fin terminated in a long cigar-shaped fairing housing the aerial of the R-847 VHF comms radio.

A curious feature of the Tu-22M0 were its six-wheel main gear bogies. To increase the bogie's footprint and thus reduce runway loading, the telescopic middle axle was extended hydraulically when the gear was down so that the middle pair of wheels had a wider track. In theory this enabled the bomber to operate from semi-prepared tactical airstrips.

The prototypes had prominent flattened fairings enclosing the main gear attachment beams. Viewed from above (eg, from a surveillance satellite), these could be confused with the characteristic main gear fairings of earlier Tupolev designs. This and probably intelligence reports of the original Tu-145 project led



Above: **One of the ten Tu-22M0s, 'Red 156' in use as an instructional airframe at the Kiyev Aviation Military Academy. The nose probe has been removed and the pilot's access hatch is open.** Aviatsiya i Vremya magazine



Right: **Large Tu-22M0 (labelled '204') used for tests in the Central Aerodynamic and Hydrodynamic Institute's wind tunnel. The multi-store bomb racks are evident.** Tupolev OKB archive

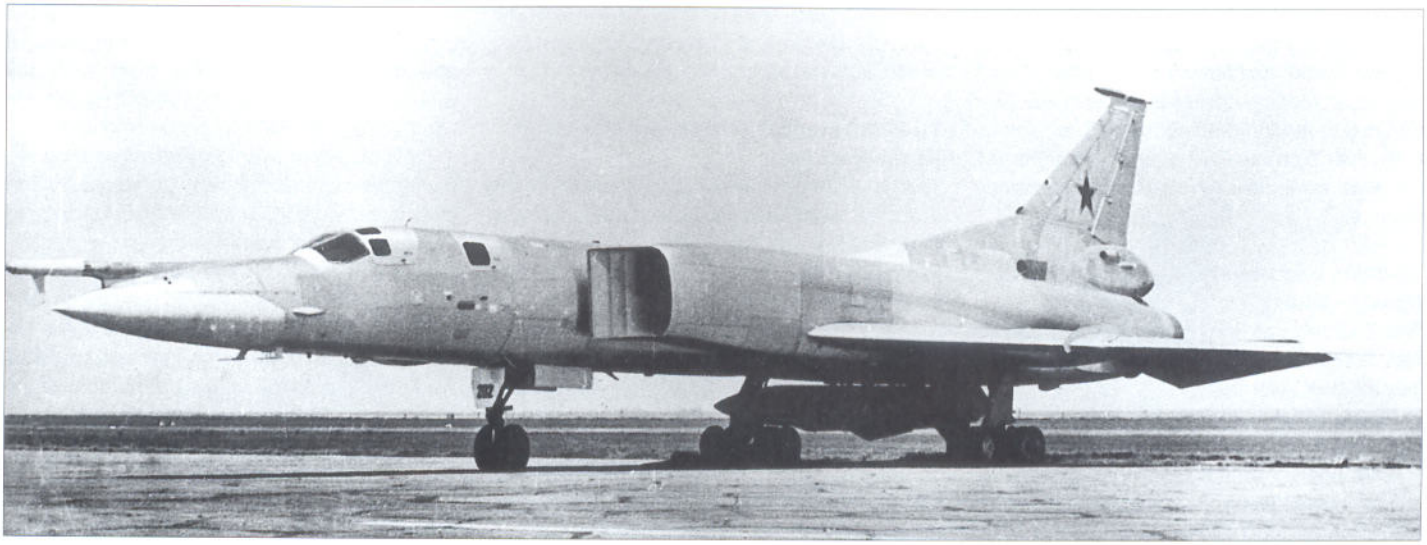
Western aviation artists to depict the aircraft with the famous gear fairings which never existed. In the West the bomber was promptly allocated the erroneous designation 'Tu-26' and the reporting name 'Backfire'.

Early Tu-22M0s lacked defensive armament. A large ECM gear fairing (misidentified by some Western analysts as 'a huge brake-chute fairing') was fitted above the engine nozzles where the guns would have been. However, the Vietnam War showed that an unarmed bomber cannot last long. The 'gun lobby' won, and the final prototypes were fitted with an UKU-9A-502 remote-controlled barbette mounting two twin-barrel 23mm GSh-23 guns (standardised tail [gun] mount, oonifitseerovannaya kormovaya oostanovka – UKU).

The GSh-23 designed by Gryazev and Shipunov is a potent weapon, as evidenced by its use on fighters and attack helicopters. On the Tu-22M, however, it was utterly ineffective since an enemy fighter could fire a missile from way out of range of the guns. Thus, the guns created merely an illusion of protection while adding about 4 tons (8,818lb) to the bomber's empty weight.

Besides shooting down unwary fighters, the guns were also to be used for passive ECM and IRCM! Quite simply, along with ordinary ammunition they could fire PRLS rounds filled with metal-coated fibreglass strips (protivorahdiolokatseeonnyy snaryad – literally 'anti-radar round') and PIKS rounds filled with a thermite mixture (protivo-infrakrasnyy snaryad – 'IR protection round'). Exploding behind the bomber, these would decoy radar-guided and IR-homing missiles.

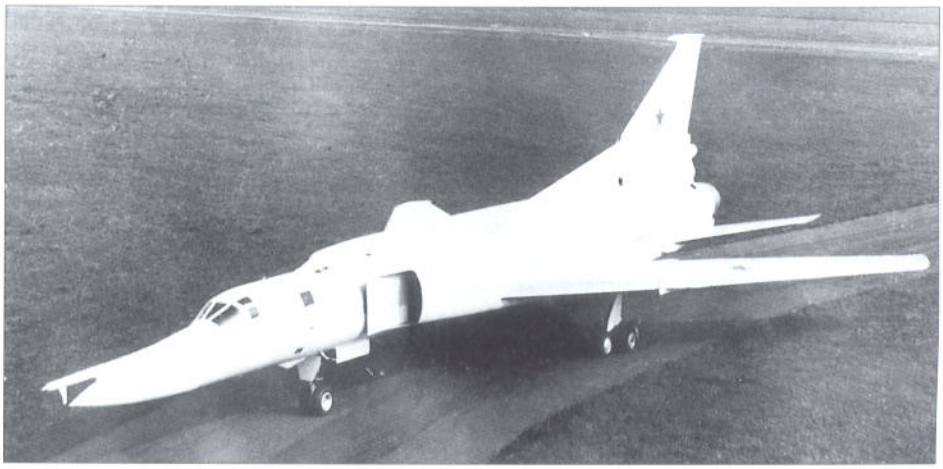
Tests showed that the Tu-22M0 had an effective range of 4,140km (2,572sm) in subsonic cruise, a top speed of 1,530km/h (950mph) and a take-off run of 2,600m (8,530ft). Wing structural strength was found to be inadequate, resulting in a take-of weight (TOW) limit of 95 ton (209,435lb) instead of the planned 121 ton (266,754lb). The Tu-22M0 was recommended for service in order to speed up conversion training for the improved production version.



Photographs on the opposite page:

Top: **The first prototype Tu-22M – Tu-22M0 No.01.** Tupolev OKB archive

Bottom: **'Blue 33' a Tu-22M0, displayed at the Monino museum.** Yefim Gordon



Photographs on this page:

Top: **Tu-22M0 No.0202 with underslung Kh-22 missile. Note '202' on nose wheel door.**

Right: **First prototype of the Tu-22M2.**

Bottom: **A Tu-22M2 prototype at Zhukovsky, during tests.** All Tupolev OKB archive

One of the early unarmed prototypes ('Red 33') became a ground instructional airframe at the Air Force Academy named after Yuri A Gagarin in Monino near Moscow and was later donated to the VVS Museum next door. Another 'Aircraft Zilch' survives as an instructional airframe at the Irkutsk Aeronautical Engineering College.

Tu-22M1 bomber/missile strike aircraft (Izdelye 45-01)

The Tu-22M1, as the pre-production version was designated, made its maiden flight on 28th July 1971. It differed from the Tu-22M0 mainly in having reinforced wings of increased span and new NK-22 afterburning turbofans.

Tests had shown that the single dorsal auxiliary air intakes of the Tu-22M0 were inefficient. Therefore, on the Tu-22M1 they were replaced by three lateral rows of three spring-loaded blow-in doors each side which opened automatically at low speed. Other external recognition features were the more angular air intakes and smaller main gear beam fairings.

The avionics were also improved, with an ABSU-145 AFCS (avtomateecheskaya bortovaya sistema oopravleniya) replacing the earlier autopilot. Two BD-45K external hardpoints were added just inboard of the wing glove/outer wing joint, permitting the carriage of two Kh-22s at a time; alternatively, the aircraft could carry up to 12 ton (26,455lb) of bombs.

The Tu-22M1 had a production run of ten. Four of these were used for performance and powerplant testing, ECM equipment and armament trials, and avionics compatibility testing, a fifth for verifying the AFCS. Yet another was a static test airframe (more static tests were required because of the new wings).

The 'M1's range was 5,000km (3,106sm) in subsonic cruise and 1,560km (969sm) at Mach 1.25. The aircraft had a top speed of 1,660km/h (1,031mph) and a 2,300m (7,545ft) take-off run. TOW still fell short of the 122 ton (268,959lb) design figure, a 110 ton (242,504lb) limit being imposed for structural strength reasons.

A few 'M1s were delivered to AV-MF units for conversion and familiarisation training upon completion of the test programme in 1975. The Tu-22M1 became a stepping stone towards production and full combat capability.

Tu-22M2 bomber/missile strike aircraft (Izdelye 45-02)

This was the first production version of the 'Backfire' which saw large scale service with both the DA and the AV-MF. The prototype, informally called 'Dvoyka' (Number Two'), had its first flight in Kazan on 7th May 1973.

Unlike previous versions, the Tu-22M2 could carry three Kh-22 missiles (two under the inner wings and one semi-recessed on the fuselage centreline). Bombs could be carried internally and on multiple ejector racks (MERs) under the air intakes. The avionics were vastly improved, featuring a new PNA target illumination/ground mapping radar, an NK-45 (navigatseeonnyy kompleks) navigation suite and new communications equipment. Thus at long last the 'Backfire' was fully equipped as intended.

External differences from the 'M1 included even smaller main gear beam fairings which now did not extend beyond the wing trailing edge. The cigar-shaped fin-tip fairing so characteristic of the early aircraft was gone, as the R-847 UHF aerial was now mounted inside the fin fillet under a large dielectric panel. The fillet was divided into three sections to compensate for in-flight deformations. Unlike the prototypes which were natural metal overall, production aircraft had medium grey upper surfaces and reflective white under surfaces.

The Tu-22M2 officially joined the VVS and AV-MF inventory in 1976, receiving the NATO reporting name 'Backfire-B'; the preceding versions (and the non-existent 'Blinder conversion' with aft-retracting main gear units) thus became the 'Backfire-A'. The Tu-22M2 had a top speed of 1,800km/h (1,118mph) and a range of 5,100km (3,169sm).

Late-production Tu-22M2s had modified wing and horizontal tail airfoil sections with a more rounded leading edge. These near-supercritical airfoils improved stability and increased lift at high alpha. Also, early production aircraft retained the prototypes' unusual variable track main gear bogies. Tests showed that the effect was negligible and the idea of operating the heavy bomber from dirt strips was dropped. Simpler and lighter bogies were fitted to 'Backfire-Bs' from Batch 34 onwards.

Tu-22Ms have seven-digit construction numbers (c/ns) but these are structured quite differently from the 'Blinder's'. The first and second digits denote the quarter and year of manufacture, the next two are the batch number. The fifth digit follows no logical sequence and remains unexplained. The sixth digit is the aircraft's number in the batch (generally five to a batch), and the final one is the number of the brigade assembling the specific aircraft.

Tu-22M3 'Red 60' (c/n 3791834), for example, was built in the third quarter (April-June) 1987 by Brigade No.4 and is the third aircraft in Batch 91; hence the fuselage number is 9103. (The same system applies to the Ilyushin Il-62 'Classic' airliner also built in Kazan.) The c/n is stencilled on the aft bulkhead of the nosewheel well; it is also embossed on a large metal plate on the rear of the nose gear oleo in the top right-hand corner.

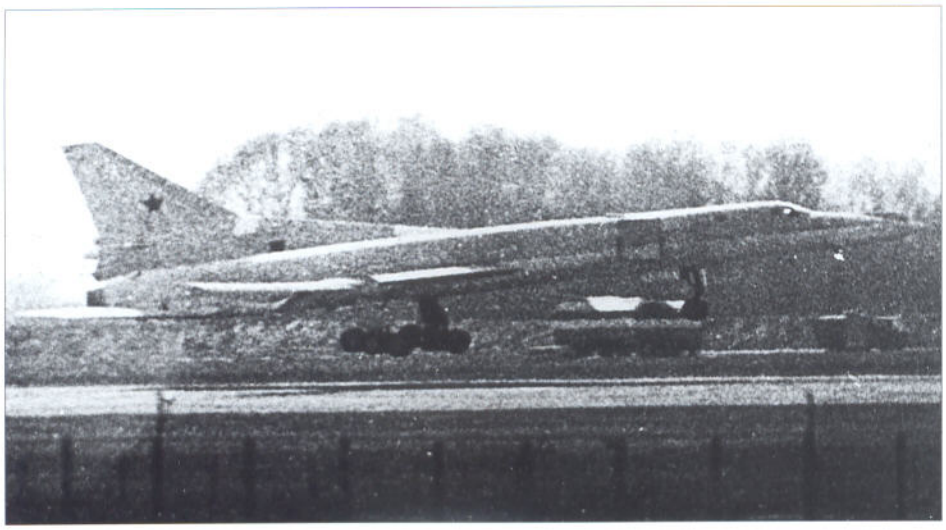
Tu-22M2Ye engine test-bed

As the Tu-22M entered service the Tupolev OKB kept working on improving the breed. Improving the thrust/weight ratio was the primary task. The NK-22, itself an uprated version of the NK-144, had virtually no reserves for further uprating. The ultimate version, designated NK-23, produced 225kN (50,705lb st) in full 'burner. A small experimental batch was built and the engine was test flown in a re-engined Tu-22M1 (which can thus be regarded as an engine test-bed).

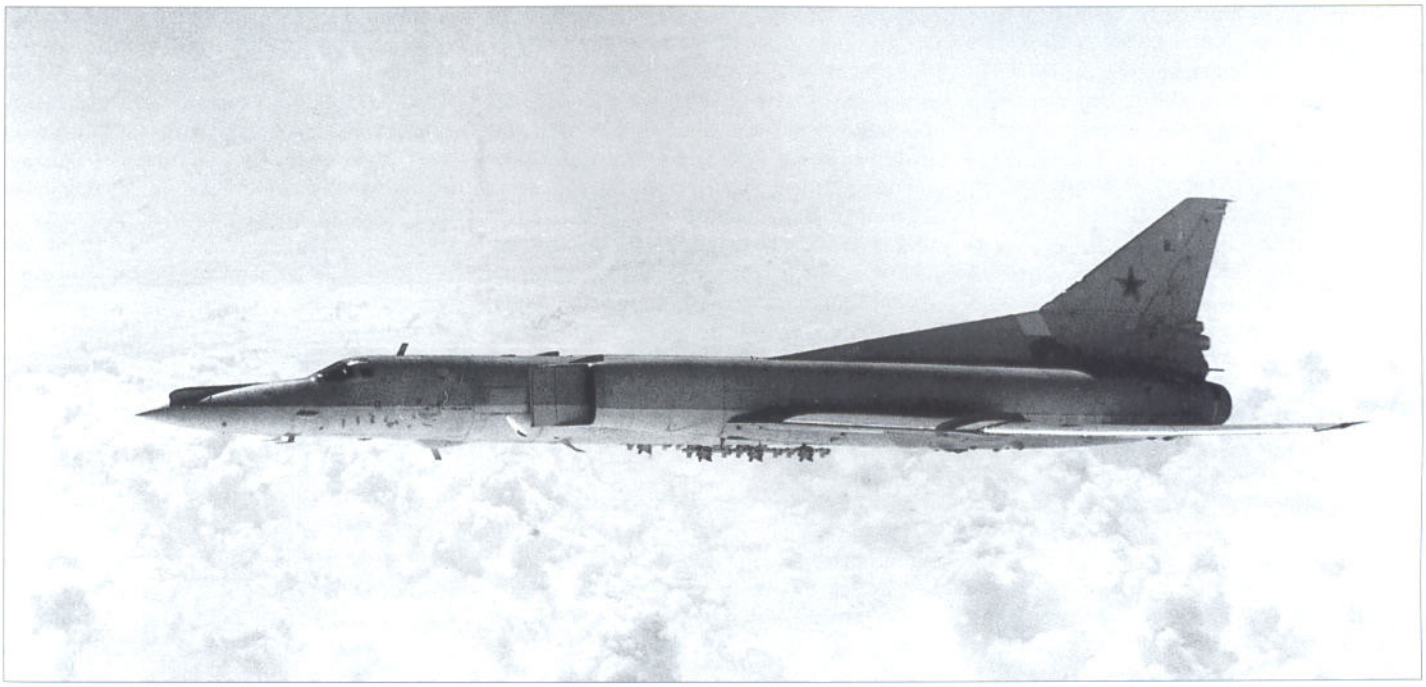
Nikolai Dmitriyevich Kuznetsov chose not to go ahead with the NK-23 as he had a new design on the drawing boards. This was the NK-25 rated at 140kN (31,525lb st) dry and 245kN (55,114lb st) reheat. Unlike the two-spool NK-22, the NK-25 was a three-spool turbofan. It featured a new automatic engine control system based on state-of-the-art semiconductors and had a slightly lower specific fuel consumption at subsonic speeds.

In 1974 a standard 'M2 was re-engined with NK-25s for powerplant tests. This engine testbed was known as the Tu-22M2Ye because the engine's OKB code was Izdelye Ye (Ye – or E – the sixth letter of the Cyrillic alphabet.)

Concurrently, in 1975-76, the NK-25 was tested on another test-bed – the Tu-142LL ('Black 043', c/n 0432), a converted late-production Tu-142 'Bear-F' ASW aircraft. This had the test engine installed in a bulbous nacelle with a foreign object damage (FOD) protection shutter over the air intake where the torpedo/sonobuoy bay used to be. (For the record, this aircraft is now retired at Zhukovsky.)



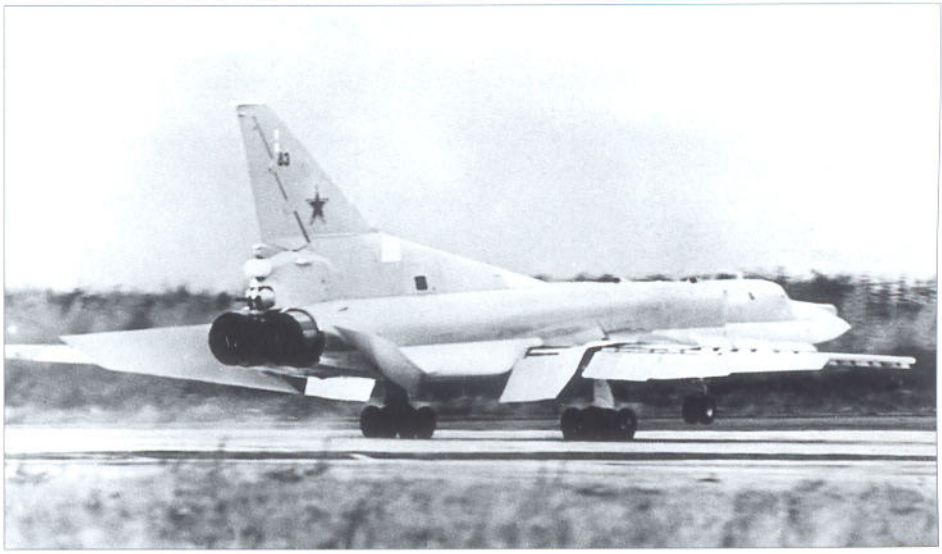
Poor shot, but an early in-flight view of one of the first Tu-22M2s during testing at Zhukovsky. Yefim Gordon archive



Above: **Excellent aerial view of '2' Tu-22M2.**

Centre right: **Tu-22M2 '83' on touch down.**

Bottom right: **Tu-22M2 in the climb, wings partially swept back.** All Yefim Gordon archive



The engine and its automatic control system worked well but it soon became apparent that simply fitting the NK-25 to the 'Backfire' was not enough. The new engine was not only more powerful but also heavier. The Tu-22M needed more refined aerodynamics and a weight-trimming diet if an improvement in performance was to be achieved. Tupolev engineers went back to the drawing board, and the result was the Tu-22M3 described separately.

Tu-22MP experimental ECM aircraft

In the late 1970s a standard Tu-22M2 was converted into an experimental communications jamming aircraft designated Tu-22MP. The aircraft was tested but did not reach the production stage because of the low reliability and poor electromagnetic compatibility of the new ECM equipment.

Tu-22M1 (mod) multi-role research and development aircraft

In the late 1970s the prototype Tu-22M1 (first pre-production aircraft) was extensively modified under a performance improvement programme which led to the next production version, the Tu-22M3. The most obvious changes concerned aerodynamics. Maximum wing sweep was increased from 60° to 65°. The fuselage nose was extended 0.8m (2ft 7.5in) and given a more pointed profile, and the refuelling probe was removed. The wings and horizontal tail received new airfoils to match current production Tu-22M2s and rudder area was slightly decreased by recontouring the rudder at the base.

The NK-25 had a greater mass airflow than the NK-22, so the test aircraft was fitted with new air intakes optimised for this engine (though the standard NK-22 engines were retained). The sharply raked intakes with horizontal variable ramps were strongly reminiscent of the MiG-25 'Foxbat' or the McDonnell Douglas F-15 Eagle.

Some structural weight reduction was also made. One weight saving area was the revised main gear bogies described earlier. The main reduction came from the wings which were made 5% lighter and stronger at the same time without affecting internal fuel volume. Improved aerodynamics and reduced weight gave the aircraft a top speed of 2,050km/h (1,273mph).

The modified Tu-22M1 also acted as a weapons, avionics and equipment test-bed for the future Tu-22M3. A new UKU-9A-502M tail gun barbette was fitted, with one GSh-23 gun instead of two placed so that the barrels were disposed vertically. Besides being much more compact and cleaner aerodynamically, it was also lighter. It came with a new PRS-4 'Krypton' gun ranging radar in a boxy truncated radome replacing the elongated one of the PRS-3.

To give the Tu-22M tactical missile strike capability the Kh-15S air-launched cruise missile, or RKV-500 (AS-16 'Kickback') was included in the bomber's weapons range. Four missiles were to be carried externally on the outer wing stations and six more on a rotary launcher in the bomb bay. This launcher was put through its paces on the Tu-22M1 test-bed.

The electric system was completely redesigned, cockpit ergonomics improved to meet crew requests, and a more compact and efficient air conditioning system was installed. The avionics suite was also upgraded. Access to systems and equipment was improved, making the Tu-22M more maintainable.

In a nutshell, this all-in-one development aircraft paved the way for a much more capable version within a remarkably short time frame.

Much of the Tu-22M3's equipment had been verified on other test aircraft or purpose-built ground test rigs; eg, the navigation suite was tested on a Tu-104A 'Camel' twin-jet airliner operated by the Flight Research Institute at Zhukovsky (LII) probably wearing the out-of-sequence registration SSSR-06195, while the new nose with the PNA radar was tested on the Tu-134SL 'Crusty' twin-jet airliner turned-avionics test-bed operated by the Leninets Production Association (converted from Tu-134A SSSR-65098, c/n 8360286, f/n 4410).

Tu-22M3 bomber/missile strike aircraft (Izdelye 45-03)

The Tu-22M3 prototype was rolled out in Kazan in mid-1977. It incorporated the various refinements tested successfully on the heavily-modified Tu-22M1 described above, including the reprofiled nose and radome, the lighter wings with 65° maximum sweep, the raked air intakes and the single-gun tail barbette. The new air conditioning system, improved cockpits and upgraded nav/comm suite tested on the R&D Tu-22M1 were also there.

There were differences. The Tu-22M3, or 'Troyka' ('Number Three'), was powered by NK-25 engines with new inlet ducts. The auxiliary blow-in doors were moved aft and the previously flat fuselage sides were sculpted, with a pronounced crease curving down to the low-mounted horizontal tail.

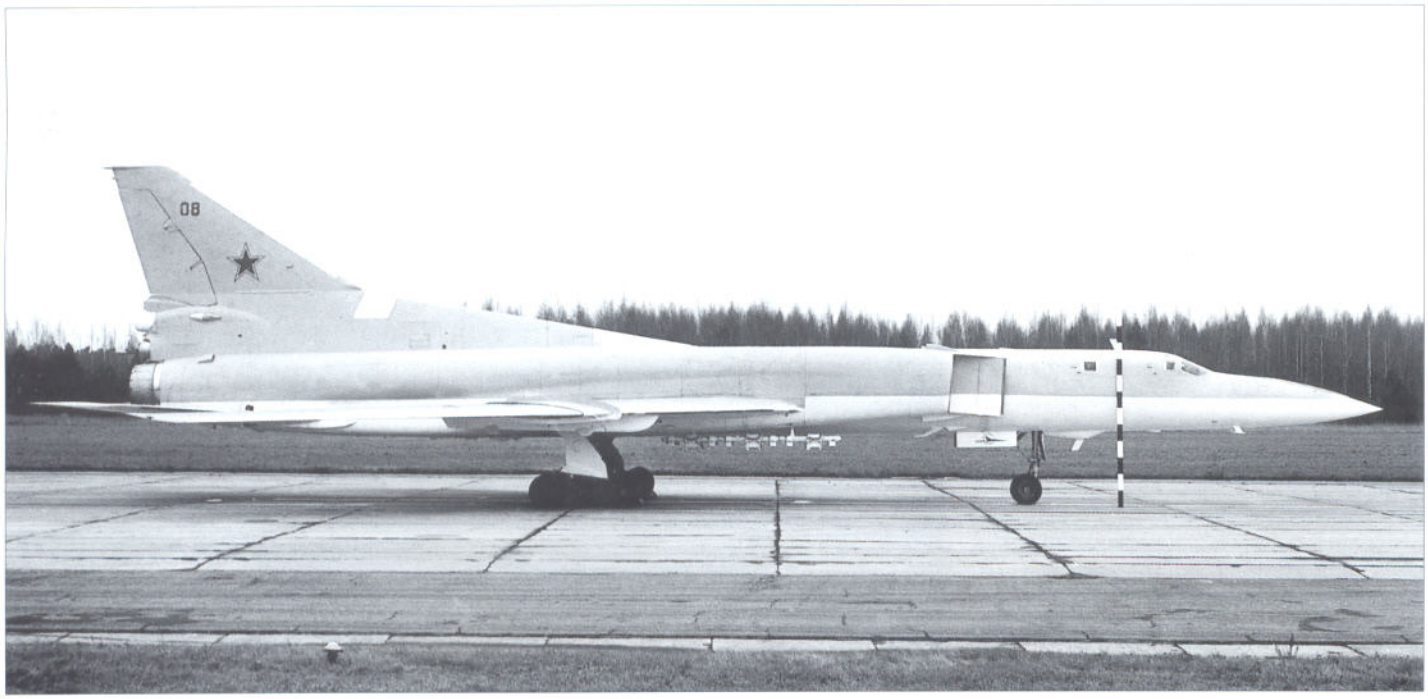
Early versions of the 'Backfire' had a 27 volt DC main electrical system with three DC generators per engine. Two direct-drive AC generators supplied variable-frequency AC, which only a small portion of the equipment could use. The constant frequency AC required by most of the avionics was provided by bulky and heavy AC converters; this was clearly unacceptable for a third-generation combat aircraft.

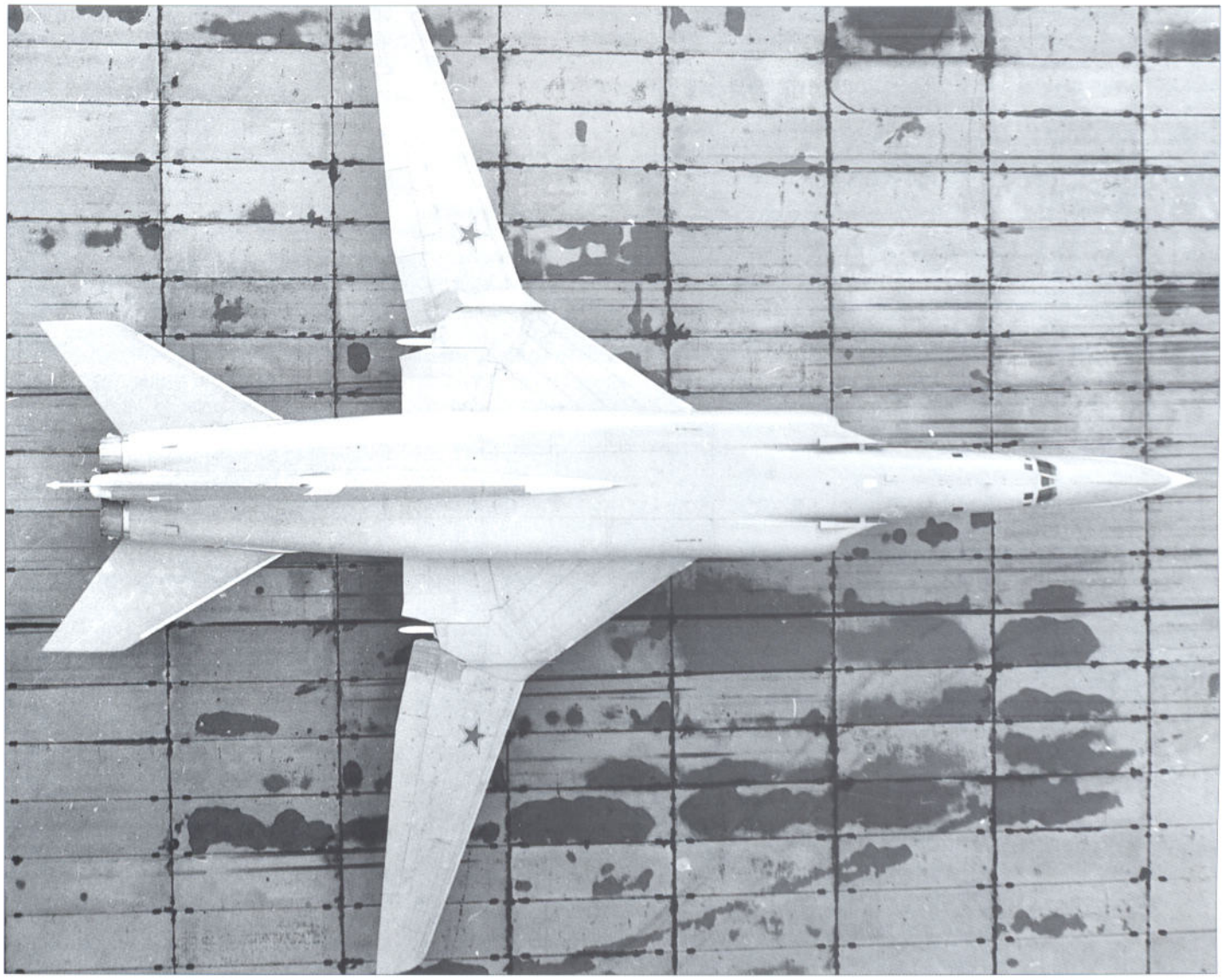
Accordingly, the Tu-22M3 got an all-new electrical system. The engines drove GT-60 NZhCh-12P AC generators via GP-23 hydromechanical constant-speed drives, allowing the AC converters to be eliminated. DC power was supplied by GSR-20BK generators; these were of the modern contactless type and had an automatic adjustment/overload protection system based on semiconductors. The lead-acid batteries were replaced by safer and more efficient nickel-cadmium units.

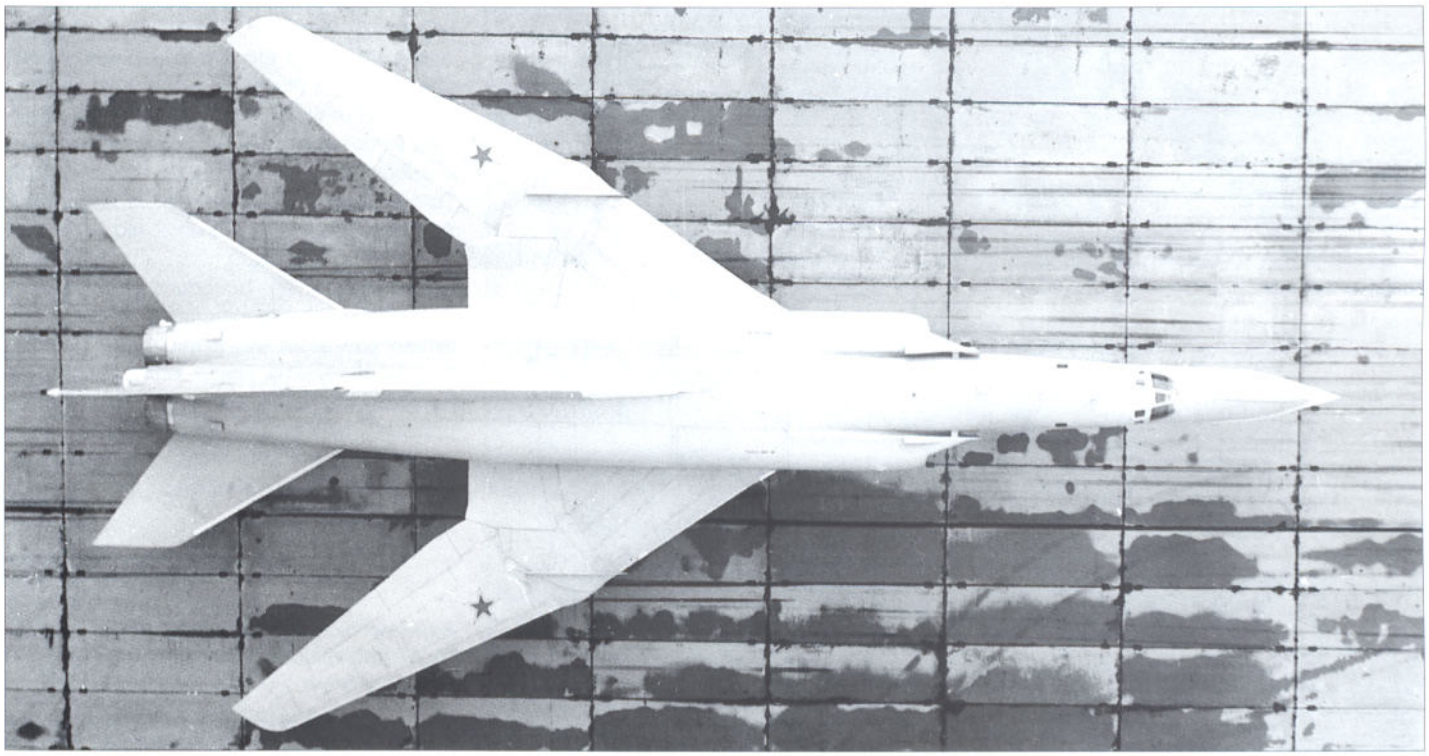
The Tu-22M3 made its first flight on 20th June 1977. Production started the following year, increasing gradually, and the 'Backfire-C' (as the aircraft was known in the West) shared the Kazan production line with the Tu-22M2 before finally taking over completely in 1984. The Tu-22M3 passed the state acceptance trials in 1981, attaining Initial Operational Capability (IOC) the same year, but it was not until five years later that it became fully operational. The type now forms the backbone of the DA and AV-MF heavy bomber force.

Early 'Backfire-Cs' retained the fixed flight refuelling probe of their forerunner, but this was soon replaced by a retractable KAZ-833 probe. Shortly after service entry the Tu-22M3 was upgraded with an MKU-6-1 rotary launcher for six Kh-15 (RKV-500) cruise missiles and new multiple ejection racks (MERs) under the air intakes. The inefficient spoilers on the inner wings were deleted on late production aircraft; the initially troublesome avionics and Elint equipment became more reliable as production progressed, and more capable ECM gear was fitted.

Below and opposite: **Three views of Tu-22M2 'Red 08' with wings fully forward and fully swept, plus side view.** All Yefim Gordon Archive







The VVS Museum in Monino has a Tu-22M3, but the aircraft is parked on a separate hard-standing some way off from the main display area and therefore is not accessible to visitors.

Tu-22M3 crew escape system test-bed

By way of experiment, one 'M3 was fitted with Zvezda K-36D ejection seats (the standard seat used on third and fourth generation combat aircraft). However, 'Backfires' continued rolling off the production line with old KT-1 seats.

Tu-22M3R reconnaissance aircraft

The VVS and AV-MF badly needed a modern reconnaissance aircraft to replace the ageing Tu-22R and Tu-22RDM, to say nothing of the hopelessly outdated Tu-16R 'Badger-E', 'F and 'K and Tu-16RM 'Badger-D'. The Tu-22M3 was the obvious choice for a new Elint platform. In the mid-1980s the Tupolev OKB came up with the Tu-22M3R advanced reconnaissance aircraft making use of the latest airborne radar and thermal imaging technology, with ample potential for future upgrades.

The first prototype entered flight test on 6th December 1985 but crashed in one of the test flights. A second aircraft configured to 'M3R standard was delivered to the Air Force Research Institute at Akhtoobinsk (NII - now renamed GLIT), and the trials resumed. In September 1995 this aircraft was in the static display during a show dedicated to NII VVS' 75th anniversary.

The 'M3R programme is making very slow progress, with production still a long way off. The reason, as usual, is the dire lack of funding and the break-up of long-standing economic ties between the aerospace industry, the electronics industry and other enterprises which found themselves in different states of the CIS.

Tu-22M3/NK-32 engine test-bed

In the early 1980s production Tu-22M3 c/n 2145345, f/n 4504, was delivered to the LII and converted into a test-bed for the NK-32 afterburning turbofan of 137kN (30,843lb st) dry and 245kN (55,115lb st) in reheat. Though originally developed for the Tu-160 'Blackjack' strategic bomber, this engine was also to power future versions of the 'Backfire' - a plan which has since been put on hold.

Appropriately coded 'Black 4504', the aircraft differed from standard Tu-22M3s in having four rows of auxiliary blow-in doors instead of three each side (ie 12 doors instead of 9). The NK-32 could also be identified by its characteristic orange coloured efflux in full 'burner indicating a high nitrous oxide content – it was a military engine and had manners to match!

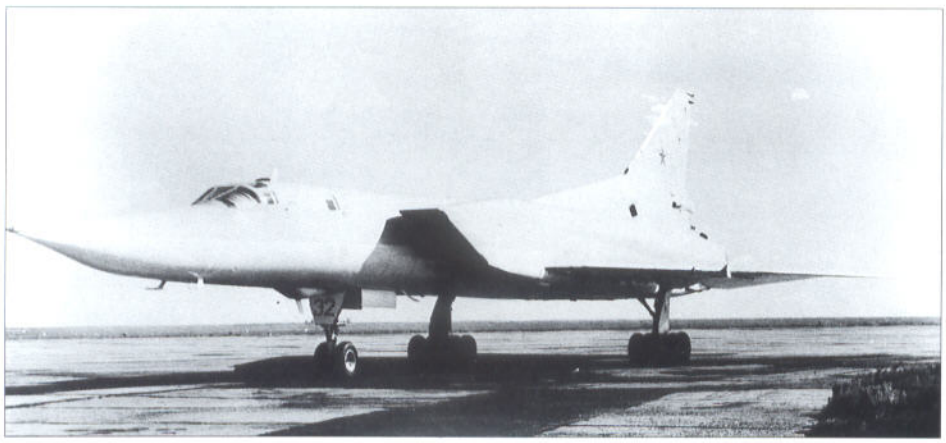
'Black 4504' took part in the flying display during MosAeroShow '92 (11th to 16th August 1992) and the MAKS-93 airshow (31st August to 5th September 1993) at Zhukovsky. At MAKS-95 (22nd to 27th August 1995) it was in the static display featuring MERs with 'iron bombs'. It was probably this aircraft that was misidentified by some western sources as the Tu-22M4. So far Russian sources have not officially confirmed the existence of such a version.

Tu-22M3-LL laminar flow research aircraft

Despite being a warplane, the Tu-22M found a civil used under the Konversiya programme (the re-alignment of the former Soviet armaments industry, perhaps best described as 'swords into ploughshares'). The bomber's high performance rendered it uniquely suitable as a supersonic airflow research aircraft. The Tu-22M3 could clock 2,300km/h (1,429mph) and withstand slipstream pressures up to 5,000kg/m^2 and the variable geometry wings allowed airflow examination at different sweep angles. Additionally, the capacious bomb bay could house a lot of test instrumentation.

In the early 1990s, the Tupolev OKB and its branches (the 'Opyt' experimental plant, the test division at Zhukoskiy etc), TsAGI and LII began a laminar flow research programme for swept wings. To this end the prototype 'M3 ('Red 32') was fitted with two bolt-on sections on the outer wings. The port one had a standard airfoil section while the starboard one was a special laminar flow airfoil developed by TsAGI using the latest techniques. The original fixed refuelling probe was enclosed by an elongated fairing to cut drag.

Calculations on boundary layer stability showed that the experimental airfoil could give laminar flow all the way to mid-chord, reducing drag by nearly 50%. The experimental sections were provided with pressure sensors to register pressure distribution and boundary layer departure over a wide range of wing settings, Mach and Reynolds numbers.

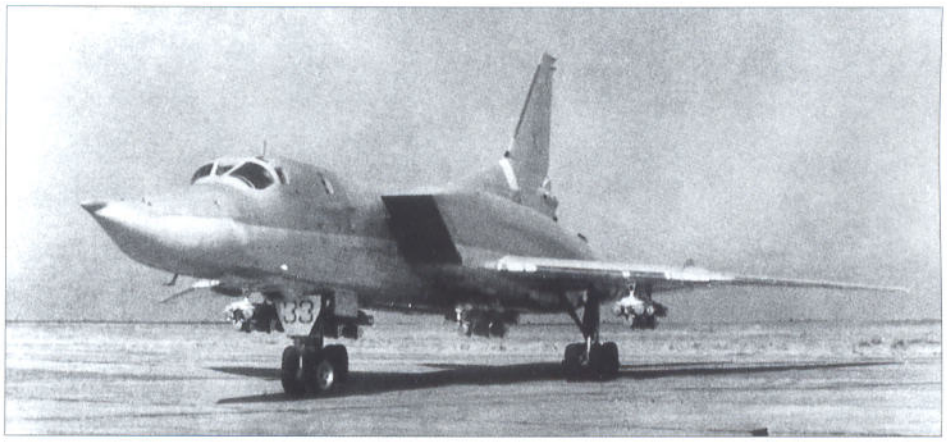


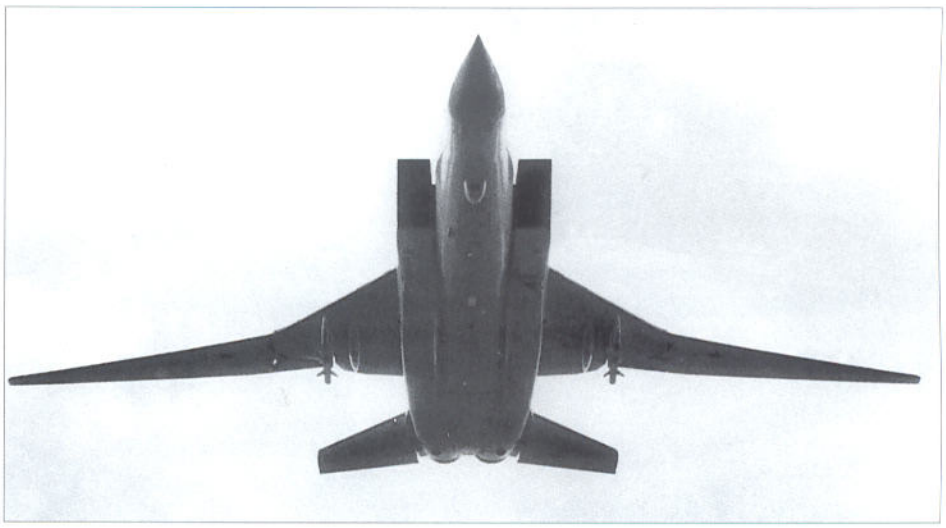
Above left: **The first prototype Tu-22MR (Tu-22M3R) which later crashed.**
Victor Drushlyakov

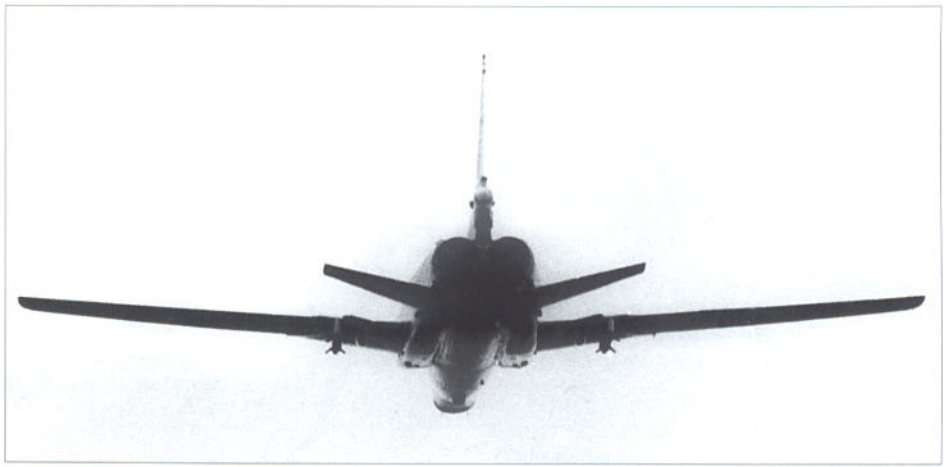
Left: **'Red 32' the first prototype Tu-22M3.**
Yefim Gordon archive

In August 1992 the Tu-22M3-LL, as the aircraft was designated, was in the static park at MosAeroShow '92 bedecked with Tupolev, LII and TsAGI badges and showing the gloss black experimental sections on the outer wings. Test flights began in the last days of December and later the aircraft was used in other TsAGI and LII research programmes. As of August 1997 the Tu-22M3-LL was withdrawn from use and in a poor state of repair.

TsAGI and LII plan to convert a Tu-22M3 for real flight testing of large scale models carried above the fuselage on pylons. At high Mach numbers a model with a 10m (32ft 9.7in) wing span can attain Reynolds numbers around 20 million, ie about ten times higher than in an ordinary transonic wind tunnel. This testing technique would be far cheaper than building large supersonic wind tunnels, for which funding is currently unavailable.







Top: **Side view of Tu-22M3 '26'.** Yefim Gordon archive

Above right: **The second prototype Tu-22M3, 'Red 33', with stores on all four multi-point pylons.** Tupolev OKB archive

Centre right and bottom right: **Forward and rear view of a Tu-22M3 in flight.** Both Yefim Gordon

TU-22M3 УДАРНОЕ ВООРУЖЕНИЕ WARLOAD

НОРМАЛЬНАЯ НАГРУЗКА
1 РАКЕТА X-22
ИЛИ 12000 КГ БОМБ

МАКСИМАЛЬНАЯ НАГРУЗКА
3 РАКЕТЫ X-22
ИЛИ 24000 КГ БОМБ

NORMAL WARLOAD
1 MISSILE X-22
OR 12000 kg BOMBS

MAX. WARLOAD
3 MISSILE X-22
OR 24000 kg BOMBS

В ГРУЗОВОМ ОТСЕКЕ
(CARRING INTERNALLY)

ВНЕШНЯЯ ПОДВЕСКА
(UNDERWING)

X-22 (3 ШТ.)

ФАБ-3000 (2 ШТ.)

ФАБ-1500 (8 ШТ.)

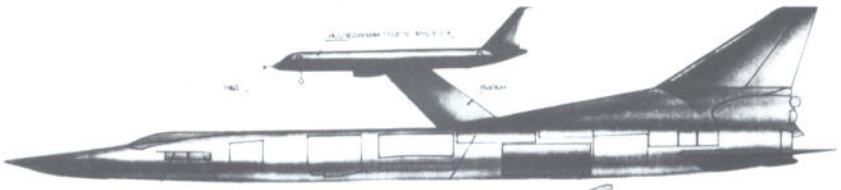
ФАБ-500 (42 ШТ.)

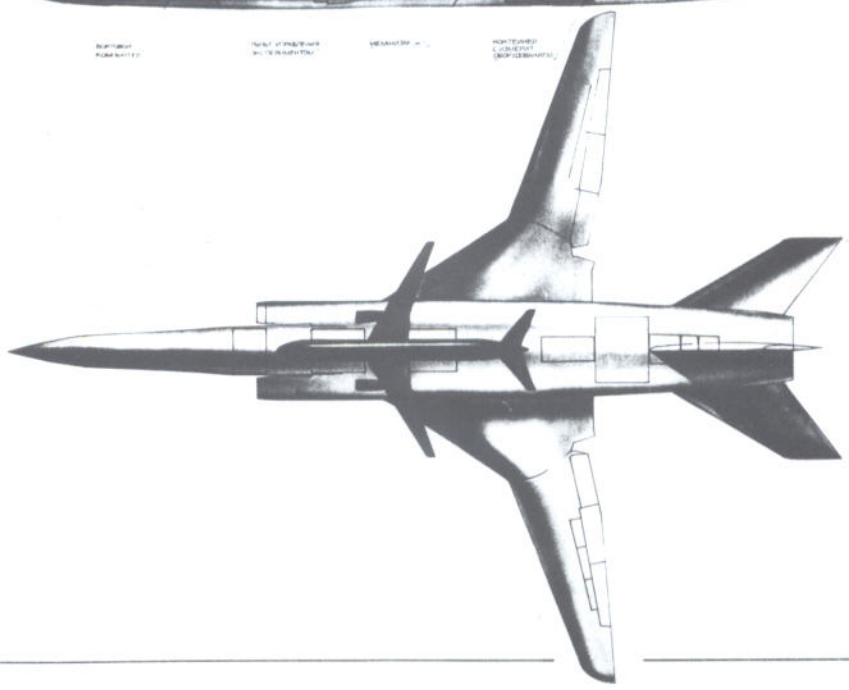
ФАБ-250 ИЛИ
ФАБ-100 (69 ШТ.)

МИНЫ В ГАБАРИТАХ
ФАБ-1500 (8 ШТ.)

МИНЫ В ГАБАРИТАХ
ФАБ-500 (18 ШТ.)

САМОЛЕТ ТУ-22М3 ЛЛ – ДЛЯ ИССЛЕДОВАНИЯ АЭРОДИНАМИЧЕСКИХ МОДЕЛЕЙ ЛЕТАЮЩАЯ ЛАБОРАТОРИЯ





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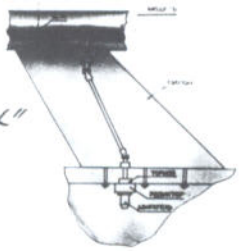
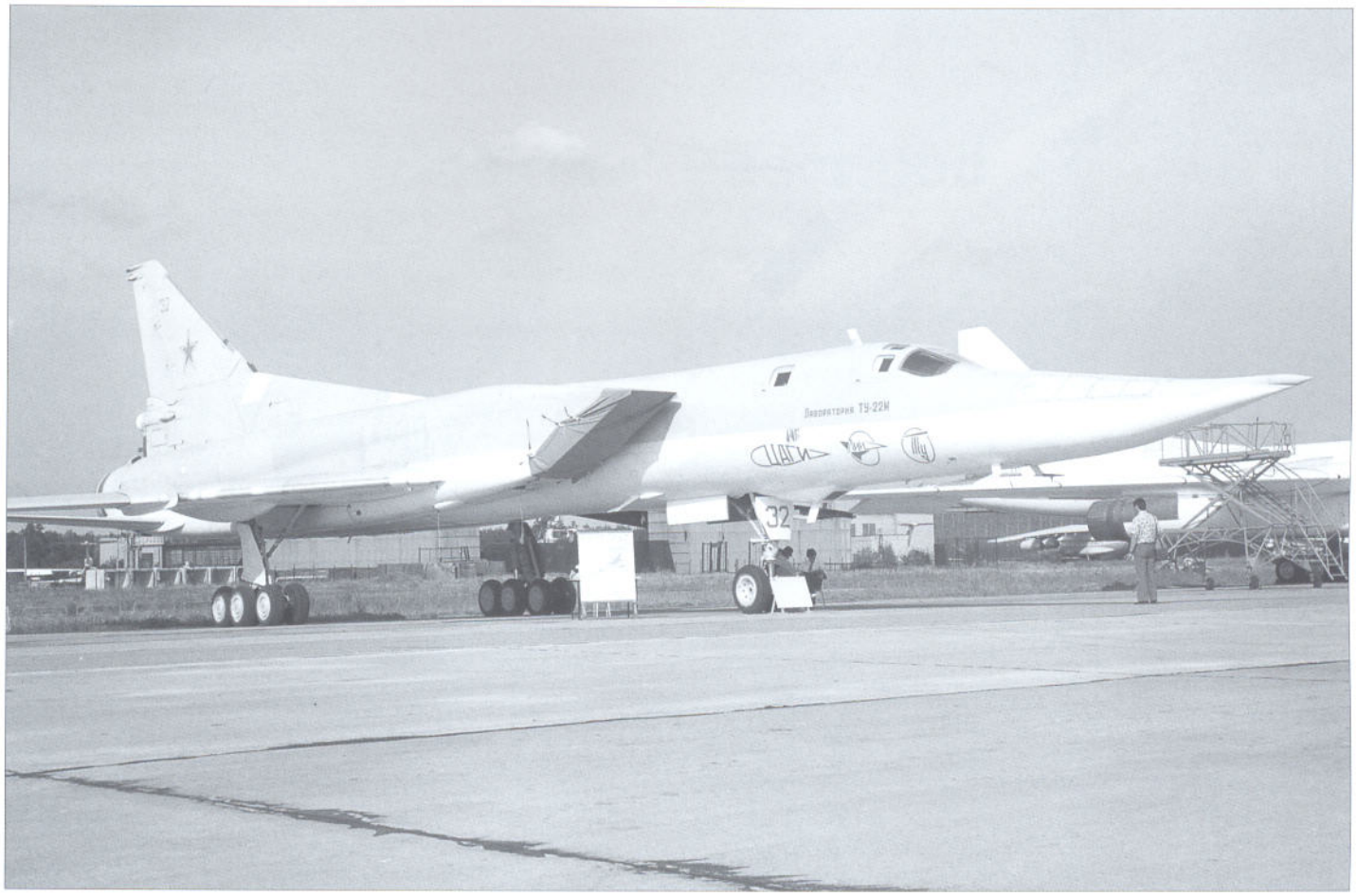


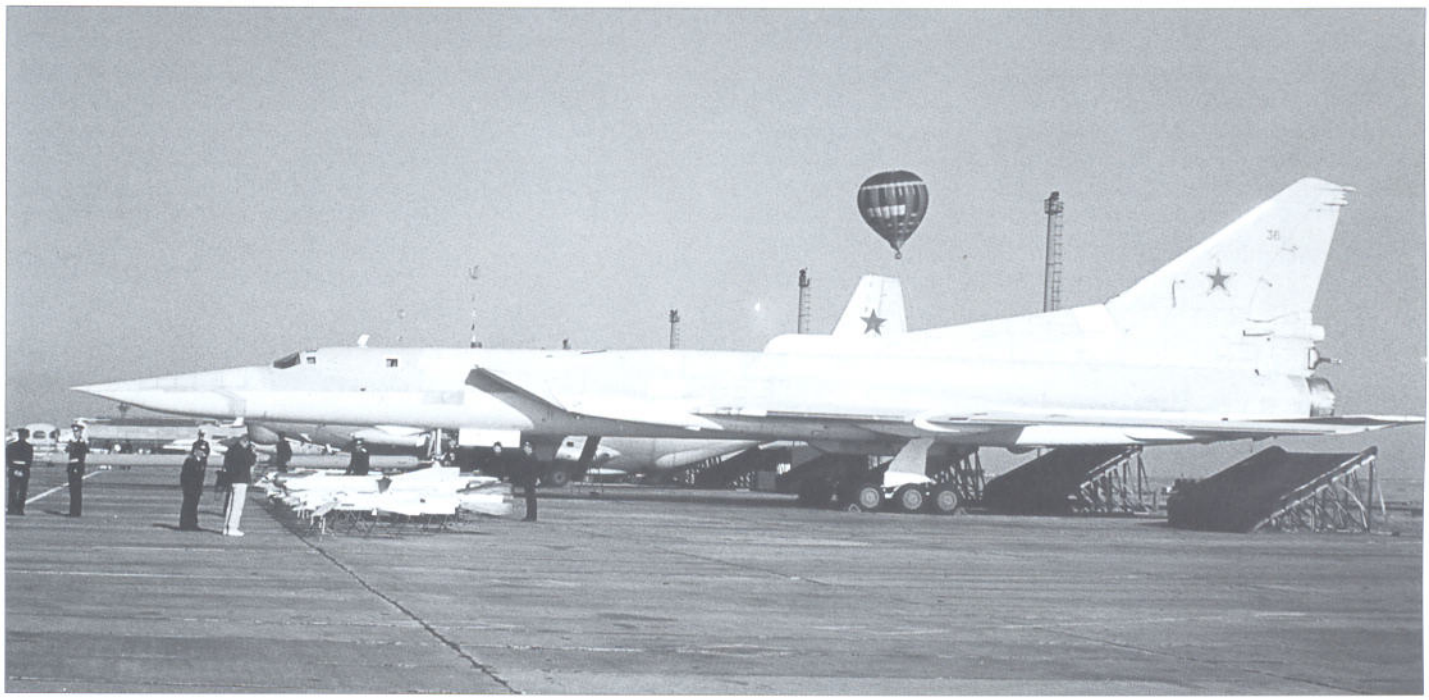
ВИДЫ ИСПЫТАНИЙ

- Обтекание модели самолета при натурных условиях /$Re = 20 \times 10^6 \div 25 \times 10^6$/;
- Поиск путей уменьшения турбулентного трения;
- Изучение вихревых течений;
- Выбор системы управления ламинарным обтеканием;
- Весовые испытания;
- Испытания с имитаторами двигателей;
- Исследование вопросов аэроупругости.

УСЛОВИЯ ЭКСПЛУАТАЦИИ

Высота полета – 1-10 км, основной режим H=2км
Скорость – соответствуют числа M=0.7-0.9
Масса модели 3000-5000 кг
Размах крыла модели $\leq$ 15 м
Продолжительность полета 0,5÷1,5 часа
Длина фюзеляжа модели $\leq$ 15 м
Диапазон углов атаки модели, изменяемых в полете -3°÷12°





Illustrations on opposite page:

Top: **Perhaps hard to comprehend from Western eyes, a publicity leaflet showing Tu-22M3 war-load combinations.**

Bottom: **Brochure detailing the plan to turn a Tu-22M3 into a carrier for large aerodynamic models. In this case, the model would appear to be a Tu-204 airliner.** Both Yefim Gordon archive

Photographs on this page:

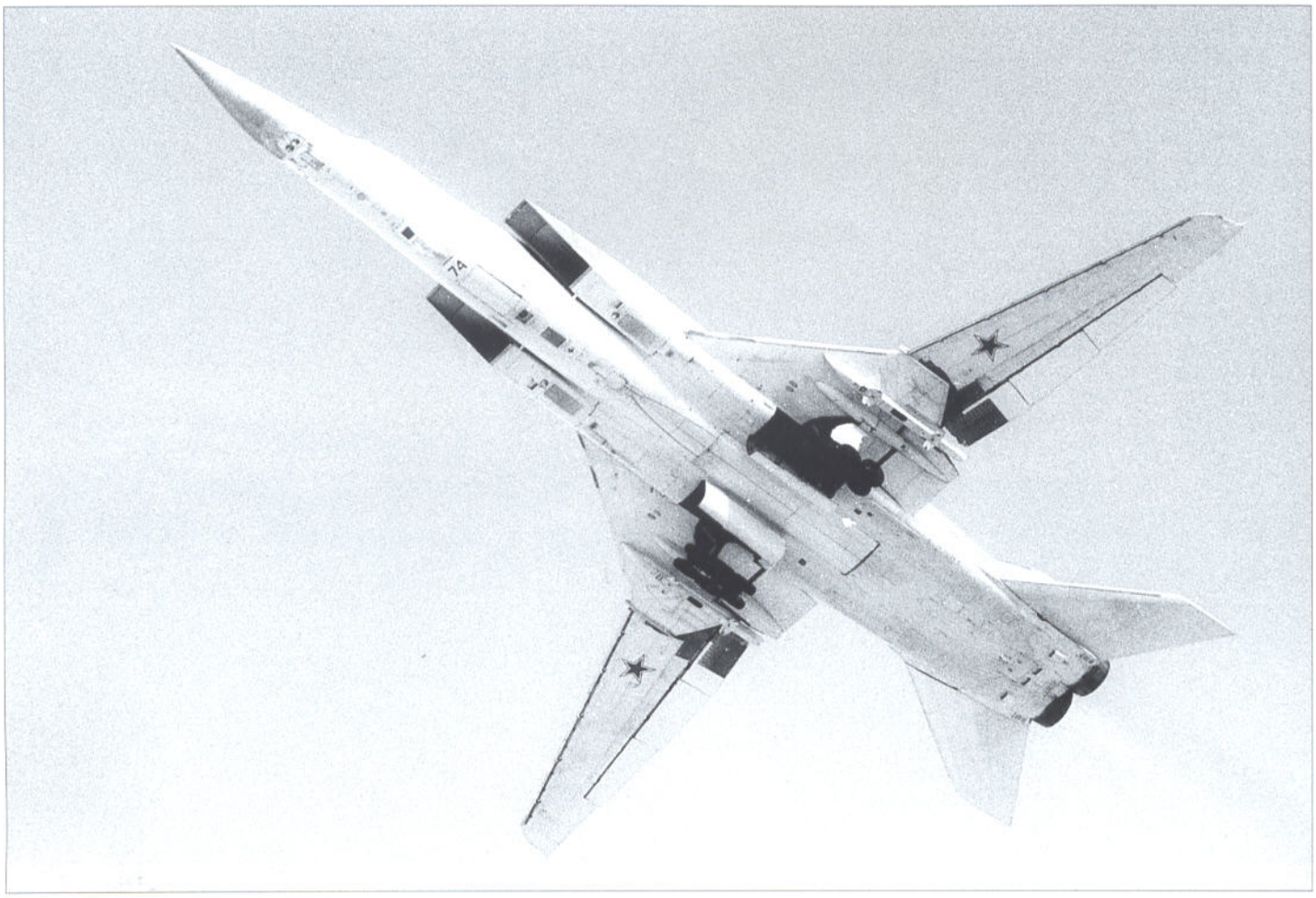
Top: **The Tu-22M3-LL 'Red 32' test-bed on display at Zhukovsky.** Yefim Gordon

Bottom: **Tu-22M3R 'Red 36' plus armament options at Akhtoobinsk.** Sergei Sergeyev

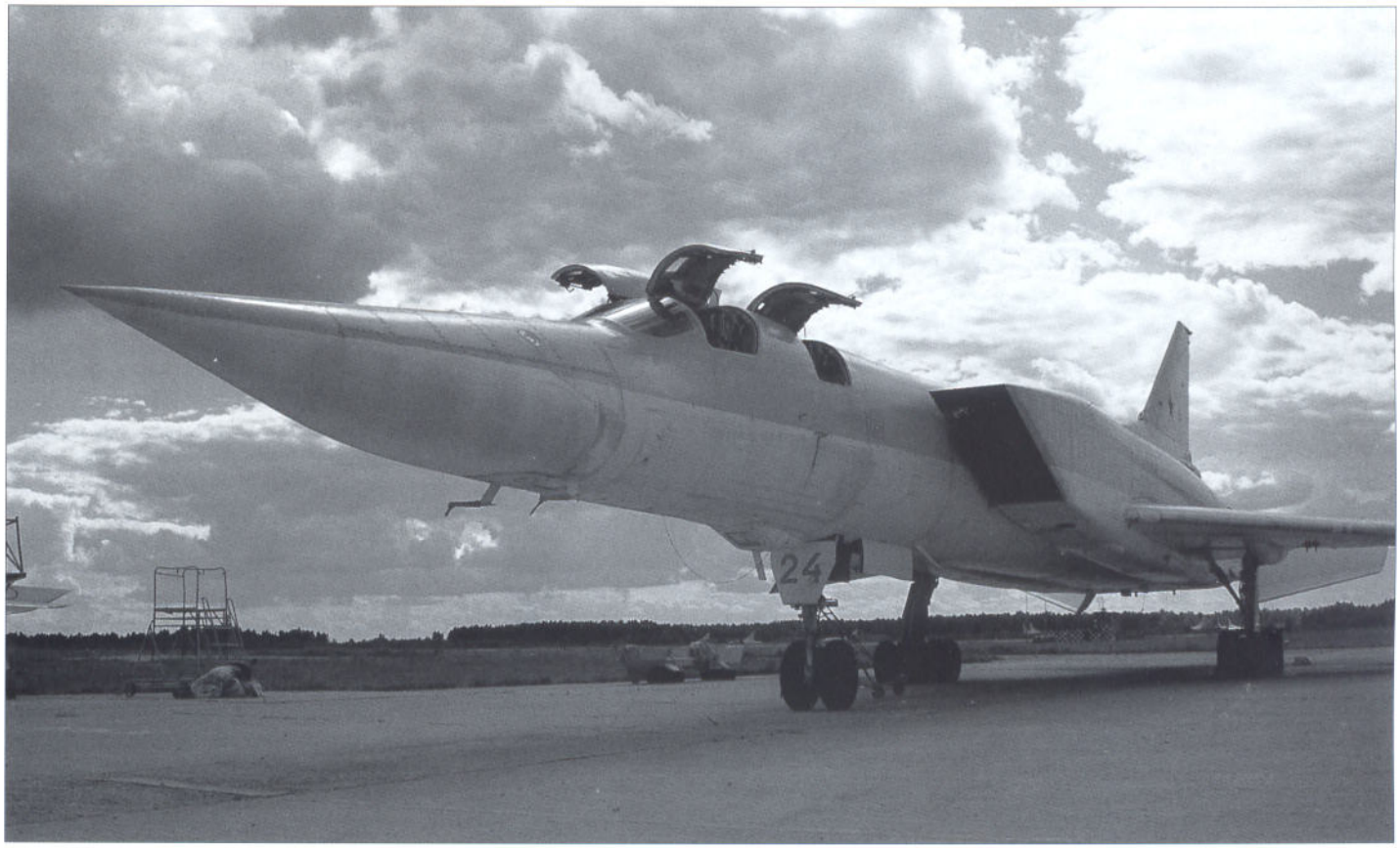
Photographs on the following page:

Top: **Detailed view of Tu-22M3 'Red 74' during take-off. Nose gear is already tucked away, the main gear has started its retraction cycle. Note the outline of the bomb/missile bay.** Yefim Gordon

Bottom: **Forward view of a probe-less Tu-22M2 at Shaikovka.** Yefim Gordon



'Backfire' Described



View of Tu-22M3 'Red 24' with all crew access doors open. Yefim Gordon

The Tu-22M2 'Blinder-B' is a supersonic long range bomber and missile strike aircraft. It is an all-metal low-wing monoplane with variable geometry wings, two afterburning turbofans, and a conventional tail unit with all-flying slab stabilisers.

Fuselage

The 'M2 has an all-metal semi-monocoque stressed-skin structure made up of four sections (No.1 and No.2 forward, centre and rear fuselage). The skin is reinforced with frames and stringers; cut outs for access hatches locations are reinforced by longitudinal and transverse beams.

The No.1 forward section (up to frame No.13) comprises the nose cone and crew compartment. The lower half of the nose cone is the radome; the upper half mounts the refuelling probe. The pressurised crew compartment seats four, with the captain and co-pilot up front while the weapons systems operator (WSO) and navigator occupy the left hand and right hand seats in the rear cockpit. The crew members enter via upward-opening entry doors hinged at the fuselage centreline; the pilots' doors incorporate sliding direct vision windows and the aft doors feature simple glazings. The front cockpit windscreen consists of an optically-flat triplex centre panel with electric de-icing and two curved Plexiglass side quadrants.

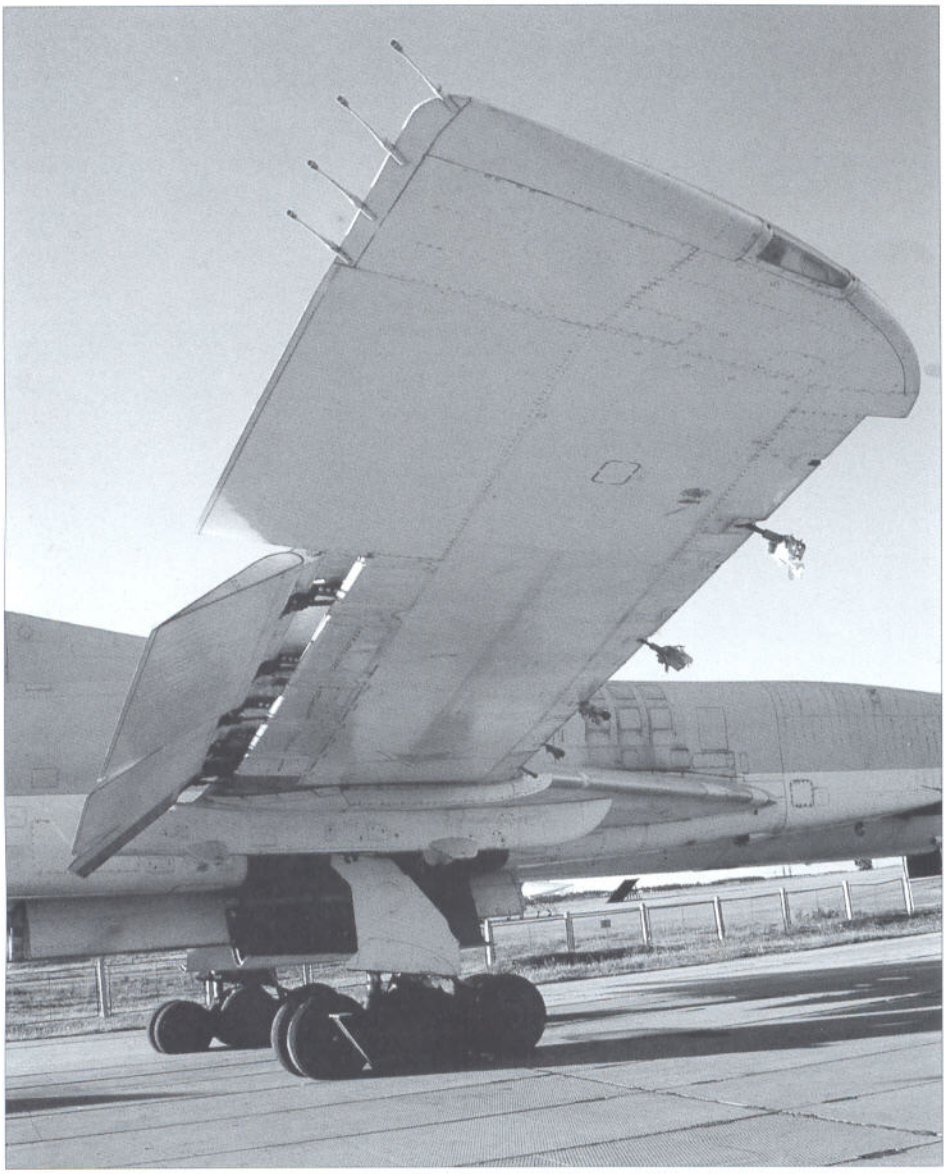
The front cockpits are equipped with flight controls, left and right pilots' instrument panels and side consoles. In the rear cockpit, the WSO panel deals with offensive/defensive weapons, ECM and communications equipment controls while the navigator's panel has the navigation systems controls.

The No.2 forward section (frames Nos.13 to 33) is divided by bulkheads into the nosewheel well, Nos.1 and 2 fuel cells (frames Nos.14 through 18 and Nos.23 through 31 respectively) and avionics bays (frames Nos.13 through 14, 18 through 23 and 31 through 33). The front and rear avionics bays have ventral access hatches, while the centre bay is accessed via the nosewheel well.

An LAS-5M inflatable rescue dinghy is stored in a bay on the starboard side between frames Nos.14 and 16. The hatch of the dinghy stowage bay can be opened both from within and from outside.

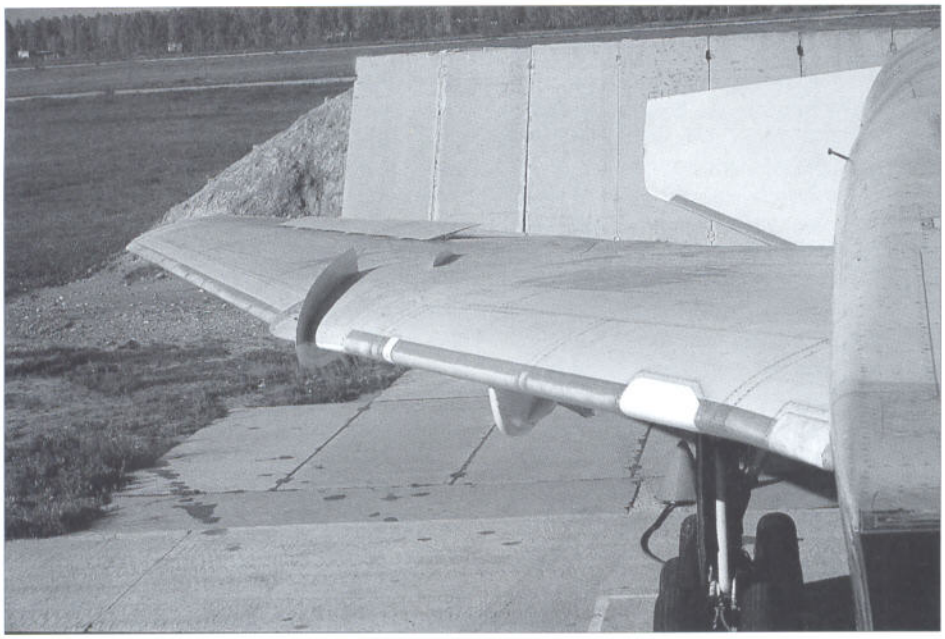
The centre fuselage (frames Nos.33 to 60) incorporates the wing carry-through box (frames Nos.33 to 44) with a fuel cell underneath and the bomb bay (frames Nos.44 to 69). The latter is closed by three-section doors which can be adapted to various weapon loads (bombs or missile); the forward sections are tailored to the shape of the missile's nose. Fuel cell No.5A is located above the bomb bay, with a further fuel cell (No.5B) under the starboard engine's air duct between frames 57 and 60.

The aft fuselage (Frames Nos.60 to 82) is integral with the centre fuselage and the fin fillet and terminates in a tail fairing. It incorporates the auxiliary power unit (APU) located in the fin fillet, lateral engine inlet ducts, the engines, the No.5 integral tank and Nos.6, 7 and 8 fuel cells. The aft fuselage carries the tail unit.



Above: **View of the starboard wing of a Tu-22M3, with the wing in the fully forward position. The leading edge slats have been removed.**

Below: **View of a Tu-22M3 starboard wing, from above. Wing in partially swept mode.** Both Yefim Gordon



To shorten the landing run a PT-12024-69 twin-canopy brake parachute is stowed in a bay in the lower aft fuselage. It is deployed and released electro-pneumatically.

Wings

Cantilever all-metal low wing two-spar structure with variable geometry. Four sweep settings - 20°, 30°, 50° and 60°. Camber –4° on outer wing panels.

Structurally the wings are made up of the centre section, inner wings, pivot joints and outer wings; the entire wing torsion box houses integral fuel tanks. The centre section is integral with the fuselage. The inner wings are fitted with slotted inner flaps, spoilers and boundary layer fences. They serve as attachment points for the air intakes, wing gloves, main landing gear units and BD-45K missile hardpoints.

The outer wings are equipped with leading edge slats, double-slotted flaps and spoilers, all in three sections. Slats are actuated by an MVD-25D25 electric drive unit and the flaps by an RP-60 hydro-mechanical flap drive unit via drive shafts, angle gearboxes and screw-jacks. The high lift devices are fully synchronised; extension (retraction) is slowed or interrupted if the slats or flaps extend asymmetrically.

Tail unit

Conventional swept tail surfaces with low-mounted all-flying stabilisers that can deflect differentially for roll control (stabilons). The fin is made up of two sections, the lower one incorporating integral fuel tank No.9; the aft end of the fin root houses the tail gun barbette. The fin fillet, in three-sections houses the APU, hydraulic equipment and avionics. The rudder has 15.1% aerodynamic balancing and mass balancing.

Landing gear

Hydraulically-retractable tricycle type. Wheel track 7.3m (23ft 11.4in), wheel base 13.675m (44ft 10.38in). The steerable nose unit retracts aft; the wheel well is closed by three doors, one of which is attached to the oleo. The unit is fitted with twin K2-100U (tyre size 1,000 x 280mm – 9.4 x 11.0in) and a combined steering actuator/shimmy damper.

The main units retract inwards into the wing roots and are fitted with six-wheel bogies (three pairs of wheels in tandem) with KT-156 wheels (tyre size 1,030 x 350mm – 40.55 x 13.77in) and disc brakes. On Tu-22M2s up to and including Batch 33, the track of the middle pair of wheels on each bogie was widened 285mm (11.22in) by a hydraulic actuator after gear extension, narrowing again before retraction. From Batch 34 onwards, simpler and lighter bogies were introduced. The wheel wells are closed by fuselage-mounted main doors and strut-mounted auxiliary doors.

Powerplant

Two Kuznetsov NK-22 afterburning turbofans rated at 196kN (44,091lb st) in full afterburner.

The NK-22 is a two-spool turbofan with a low pressure (LP) compressor, a 6-stage high pressure (HP) compressor, an annular combustion chamber, a HP turbine, an LP turbine, an afterburner and a convergent-divergent nozzle. The engine is started by an air turbine starter (ATS) using compressed air supplied by the APU.

The engines breathe through mixed-compression lateral supersonic air intakes. The *variable* intakes feature three-section vertical ramps and fixed boundary layer splitter plates. The inlet duct cross-section changes gradually from rectangular at the intakes to circular at the compressor faces. The middle section of each inlet duct incorporated nine auxiliary blow-in doors and an excess air bleed door. The variable intake ramps are controlled by separate (port and starboard) SU-39 control systems (sistema oopravleniya).

Compressed air for engine starting and ground/emergency power for systems and equipment is provided by the Stoopino Machinery Design Bureau TA-6A APU located in the fin fillet.

RT brand jet fuel is carried in ten integral tanks and fuel cells in the fuselage, the fin root integral tank and inner/outer wing integral tanks. The tanks are divided into groups and the fuel transfer sequence is determined by the TATs 3-1V fuel metering system automatically maintaining cg position. The fuel tanks are pressurised with inert gas to reduce fire/explosion risk in the event of damage.

The Tu-22M2 is equipped for single-point pressure ground refuelling and had a hose-and-drogue flight refuelling system with a PT-1 fixed telescopic refuelling probe ahead of the windscreen; however, the latter has since been removed to reduce range in keeping with the SALT-2 arms reduction treaty. Gravity refuelling via fillers on the upper side of the wings and fuselage is also possible. A fuel jettisoning system is provided.

Armament

The Tu-22M2's offensive armament typically comprises one to three Kh-22M ASMs carried semi-recessed on a BD-45F rack on the fuselage centreline and externally on BD-45K hardpoints under the inner wings. (BD, bahlochnyy derzhahtelí – beam-type [weapons] rack for Izdelye 45; F, fyuzelyazhnyy – fuselage-mounted; K, kryliyevoy – wing-mounted.) Free-fall bombs and anti-shipping mines can also be carried. Bomb load totals 24 tons (52,910lb) and may consist of 100kg (220lb), 250kg (551lb), 500kg (1,102lb), 1,500kg (3,306lb) and 3,000kg (6,613lb) bombs. These are carried internally on BD6-105A beam-type racks, KD3-22RD, KD3-22M and KD4-105AD cassette racks, or externally on removable MBD3-U9 multiple ejection racks (MERs) under the air intakes. Typical loads include 69 FAB-100s, 69 FAB-250s, 42 FAB-500s, eight FAB-1500s, two FAB-3000s, 24 FAB-500s plus eight FAB-1500s, or 24 FAB-500s plus a single Kh-22M missile on the centreline.

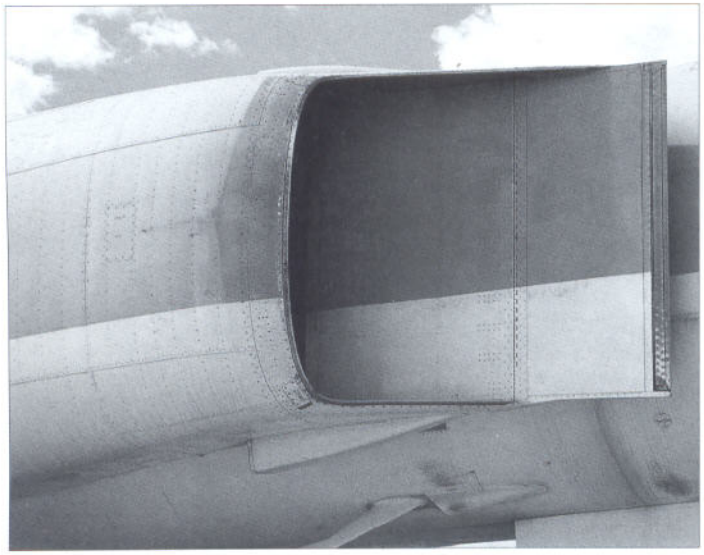
Tu-22M3 showing detail of the all-flying stabilisers which can act in differential mode for roll control (as 'stabilons'). Yefim Gordon

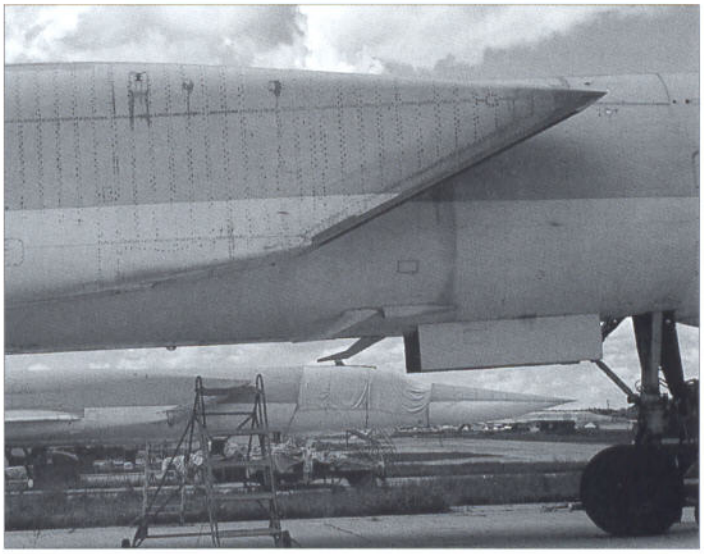
Bomb aiming is by means of the OPB-15T optical/TV sight installed in a fairing under the front cockpit and the PNA ground mapping radar, also used for target illumination during missile strikes.

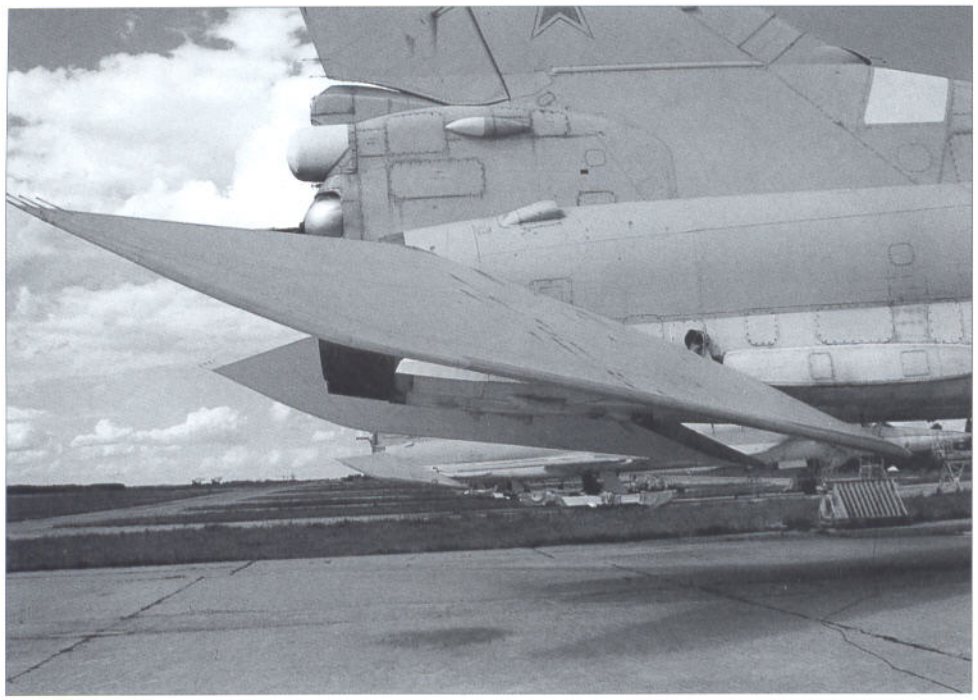
Defensive armament consists of an UKU-9A-502 remote-controlled tail gun barbette with two 23mm (0.90 calibre) GSh-23 twin-barrelled guns (600rpg, rate of fire 2,600rpm). The guns are aimed by a TP-1 TV sighting system and a PRS-4 'Krypton' gun ranging radar.

Avionics and equipment

The Tu-22M2's avionics suite includes a KUS-2500 ASI, VD-20K and UVID-30-30K altimeters, a VAR-75MK variometer, an AUASP-31KR automatic alpha and g limiter, an AGR-72 artificial horizon, an EUP-53MK electric turn indicator, a 'Bort-45' trajectory control system and an ABSU-145M AFCS.







Top left: **Close-up of the nosewheel on 'M3 'Red 60'. The unit is similar on both the 'M2 and 'M3.**

Top right: **Main undercarriage – again, similar on both the Tu-22M2 and 'M3.**

Above left: **Engine intake, Tu-22M2.**

Above right: **Engine intake, Tu-22M3.**

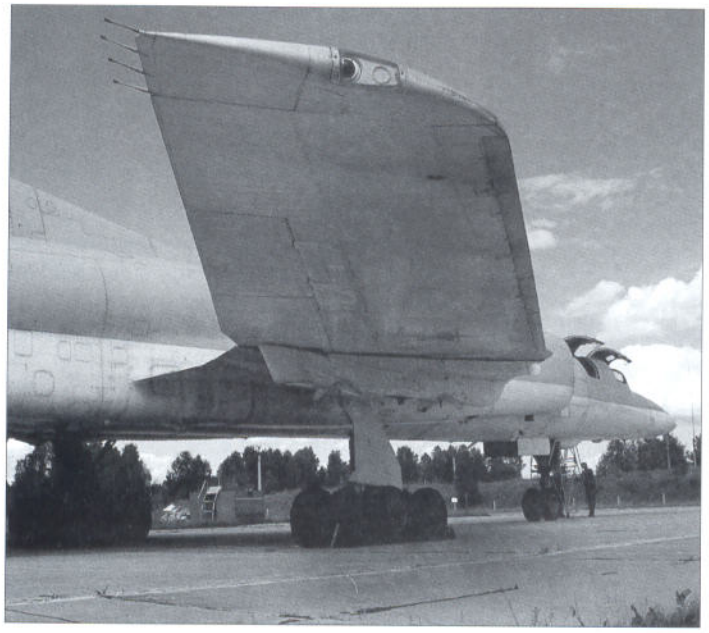
Left: **Tu-22M3 'Red 24' tail section. Note detached weapons pylon in background.**
All Yefim Gordon

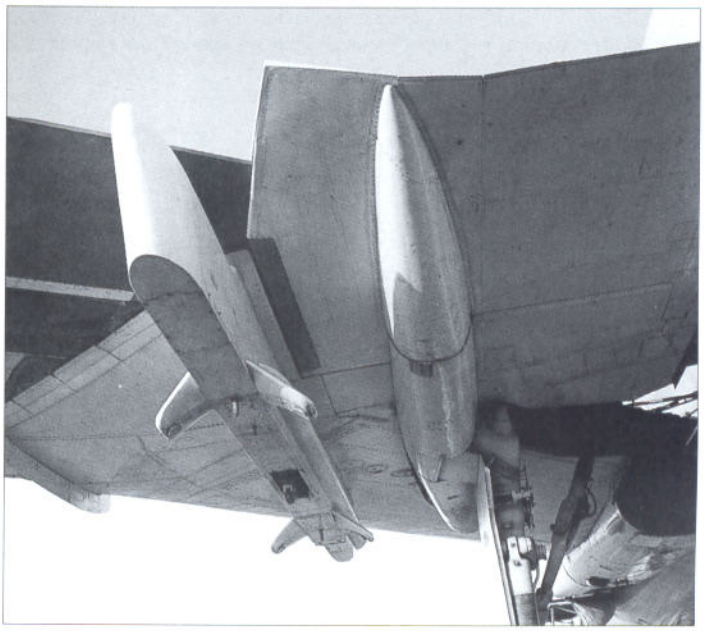
Photographs on opposite page:

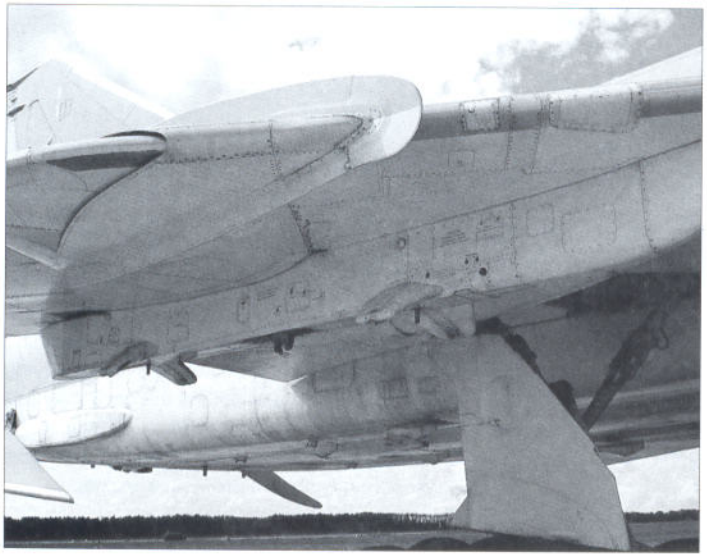
Top left, top right and centre left: **Views of the Tu-22M3 port outboard weapon pylon and wing 'glove'.**

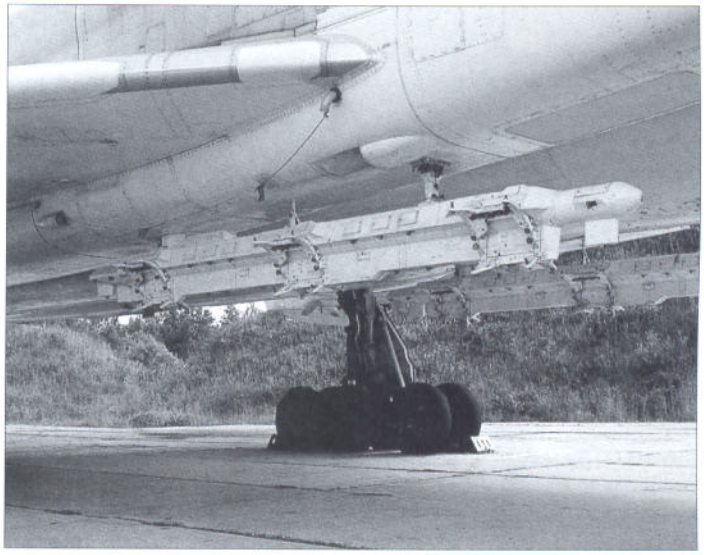
Centre right: **Tu-22M3 multi-store inboard weapons pylons.**

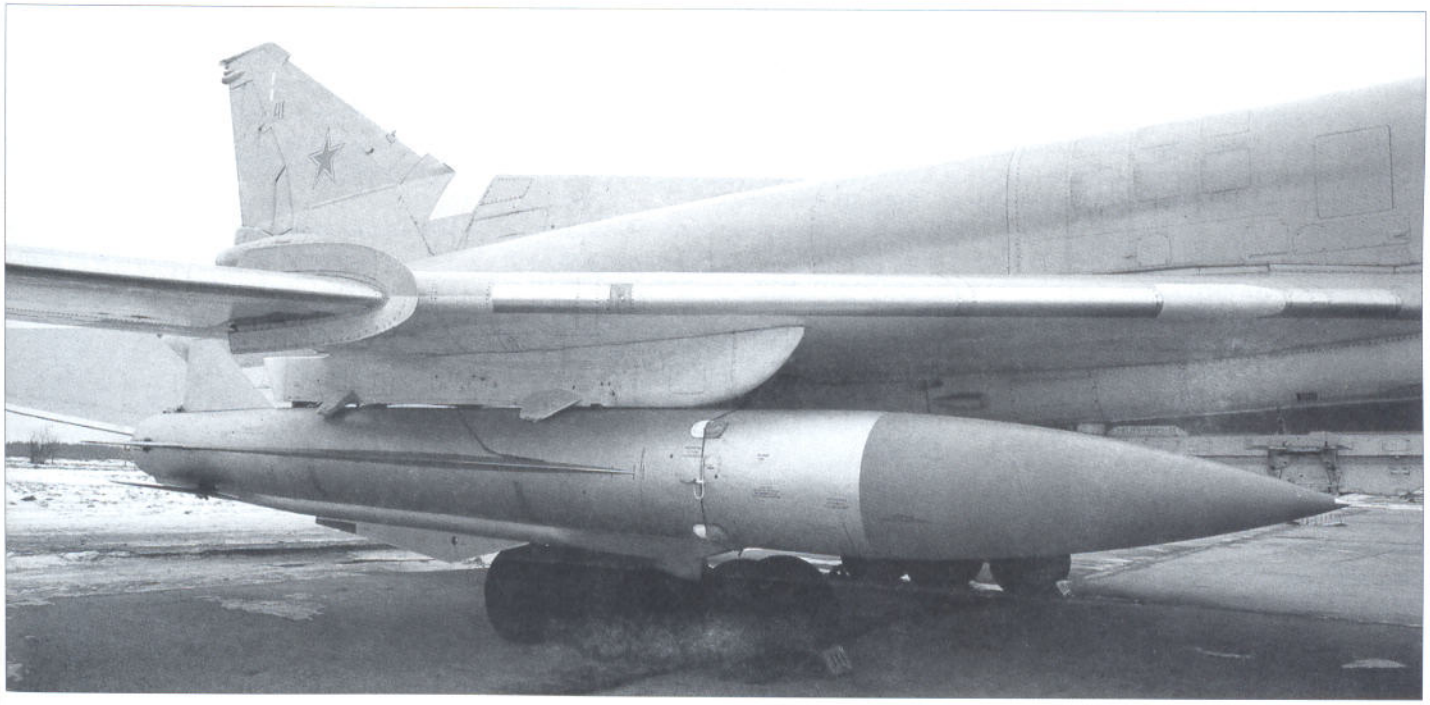
Bottom: **Kh-22M missile on the starboard outer weapon pylon of Tu-22M3 'Red 41'.**
All Yefim Gordon











Engine RPM are displayed by ITE-27 gauges. The engine instruments also include IP-35-01 air intake ramp/blow-in door position indicators; 24A-7A-550 exhaust gas temperature sensors and indicators; UIZ-9 multi-function gauges which indicate afterburner fuel pressure, oil pressure and incoming oil temperature, and an engine vibrations sensor/warning system. For mission debriefing or accident analysis the Tu-22M2 is equipped with KZ-63 and MSRP-64 flight data recorders.

The navigation suite (primarily the NK-45 navigation system) comprises two RV-5 low altitude radio altimeters (0 to 750m – 2,460ft) which double as a ground proximity warning system; an RV-18G high altitude radio altimeter; an ARM-15M ADF; an ARK-U2 UHF ADF; a DISS-7 Doppler radar (ground speed and drift indicator); RSBN-PKV SHORAN; an ARP-69 VOR/localiser receiver, a GRP-66 glideslope receiver and an MRP-66 marker beacon receiver forming part of the 'Osi-1' (axis) instrument landing system.

Comms equipment comprises an SPU-7 intercom, two R-832M HF ATC radios, an R-847 UHF comms radio (transceiver), an R-876 receiver and two RI-65B voice alert systems informing the pilots of critical failures or dangerous flight modes. The rescue dinghy is equipped with an R-855-9M emergency call radio. The aircraft is also fitted with an Izdelye 023 IFF and an SO-69 ATC transponder.

Control system

The Tu-22M2 has dual controls. All control surfaces – rudder, spoilers and differentially deflectable slab stabilisers (stabilons) – are powered by irreversible hydraulic actuators; there is no manual back-up. The RP-64 rudder actuator and RP-63A stabilon actuators receive inputs from control columns and rudder pedals via single push-pull rod linkage; the spoilers have fly-by-wire (FBW) control.

The electro-hydraulically actuated inboard spoilers/lift dumpers act as airbrakes. The outboard (flight) spoilers with RA-57 hydromechanical actuators are used for roll control at low and medium speed; the stabilons take over automatically when the wings are in the maximum sweep position or if the flight spoiler control circuit fails.

The control system features artificial 'feel' mechanisms with a trim function. The pitch and yaw channels have additional artificial 'feel' mechanisms creating additional stick and pedal forces during manoeuvres at the limits of the aircraft's flight envelope. There is also a stick-pusher triggered by the automatic alpha and g-limiter.

The Tu-22M2 is equipped with an ABSU-145M automatic flight control system (AFCS) allowing pilots to fly the aircraft manually or in autopilot mode. Wing sweep is changed by an RP-60 actuator with dual hydraulic motors and VP-2 screw-jacks; the control inputs are transmitted electronically ('pivot-by-wire'). Sweep is controlled either manually or automatically from either pilot's seat; in automatic mode the wings can assume any sweep angle besides the preset positions (20°, 30°, 40°, 50° and 60°).

Crew escape system

The Tu-22M's crew escape system comprises the access hatch (canopy) jettisoning system, four Tupolev KT-1 ejection seats with KSN-T-45 ejection guns, an ejection envelope limiter and control unit, ground handling safety pins, the PS-T parachute system and the NAZ-7 survival kit. An LAS-5M inflatable rescue dinghy is provided in case of ditching or over water ejection.

The crew members may eject individually, or the captain may initiate ejection, punching out all four crew members if any of them are disabled. In the latter case the ejection sequence is: WSO, navigator, co-pilot and captain

Ejection is possible at any altitude except low altitude during descent. Minimum ejection speed is 130km/h (80mph) for individual ejection or 300km/h (186mph) for a simultaneous ejection.

Hydraulics

The Tu-22M2 has three separate hydraulic systems. They feature hydraulic reservoirs located in the fin fillet, engine-driven hydraulic pumps (NP-89 in system No.1, NP-85 in Nos.2 and 3), TNUA ram air turbine-driven emergency pumps, and hydraulic pressure accumulators. Equipment using hydraulic power (eg, control surface actuators) is powered by several systems so that failure of a single system does not disable the hydraulic drives.

The systems are filled with AMG-10 hydraulic fluid (187 litre – 41.14 Imp gallons, in Nos.1 and 2; 73 litre – 16.06 Imp gallons in No.3); nominal pressure is 210kg/cm^2 (3,000lb/in^2).

Electrics

The Tu-22M2 has four electric subsystems:

1 27 volt DC with six GS-18NO generators (three per engine), one GS-12TO generator driven by the APU and SA-55 batteries as backup power.
2 115 volt (400Hz) single-phase AC with three PO-6000 AC converters (one is a backup in case one of the others fails) and one PO-500A converter;
3 36 volt (400Hz) three-phase AC with two PT-1000Ts AC converters (one is a backup) and one PT-200Ts converter;
4 208 volt variable-frequency three-phase AC with two engine-driven GT60P45 generators plus a third driven by the APU (for powering equipment which is impervious to AC frequency alterations).

Air conditioning

The Tu-22M2 is equipped with an all-round air conditioning system (ACS) catering for both crew and equipment. It provides adequate ventilation and comfortable temperature in the pressurised cockpits and in the avionics bays throughout the aircraft's flight envelope. The ACS uses engine bleed air.

Oxygen system and pressure suits

The oxygen system supplies the crew with oxygen both in normal flight and in the event of decompression. Gaseous oxygen is stored in seven 25 litre (5.5 Imp gallon) spherical bottles pressurised to 150kg/cm^2 (2,142lb/in^2). The crew's oxygen equipment includes KP-52M oxygen masks for normal flight and KP-27M portable oxygen gear for ejection (KP, kislorodnyy preebor – oxygen set).

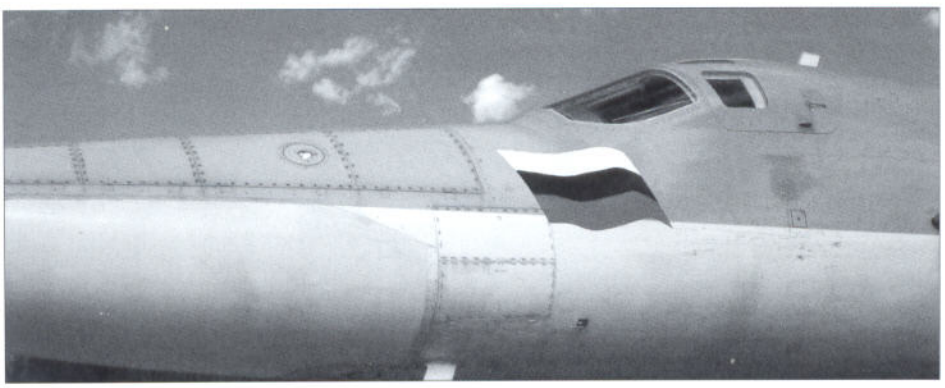
The crew wears special suits in order to stay in working condition throughout the aircraft's flight envelope and survive high altitude ejections and parachute landings into water. The outfit includes the VKK-6MP (vysotno-kompenseeruyuschchiy kostoom) g suit, the GSh-6A (ghermoshlem) pressure helmet, the VZK-2M (vodozaschchitnyy kostoom) waterproof suit, the TZK-2M (teplozaschchitnyy kostoom) hypothermia protection suit (for ditching in cold water), heat-insulated gloves and flying boots. For over water sorties the crew may use the VMSK-4 (vysotnyy morskoy spasahtelínyy kostoom) maritime protective suit and ZSh-5A (zaschchitnyy shlem) protective helmet.

Pneumatic system

Pneumatically-actuated equipment uses compressed air in bottles pressurised to 150kg/cm^2 (2,142lb/in^2). Compressed air is used for fuel jettisoning, canopy jettisoning prior to ejection, pressurising the hydraulic reservoirs, deploying and releasing the brake parachute and cooling some of the avionics.

Fire suppression system

The fire suppression system is similar to that of the Tu-22, see Chapter Three.



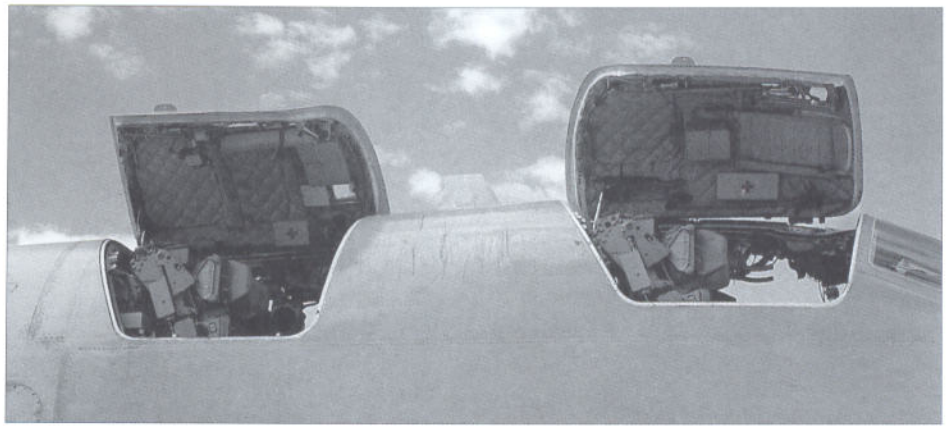
Photograph on opposite page:
Close-up of the cockpit and 'banner' marking on the nose of a Tu-22M2.

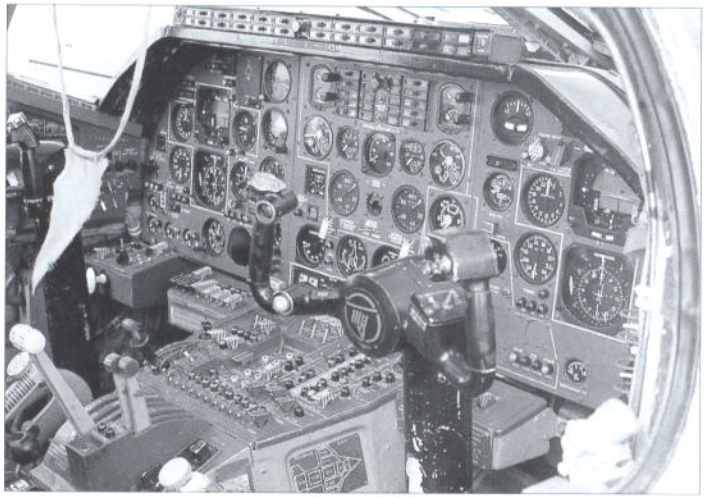
Right: **Detail of the crew access/escape doors on a Tu-22M3.**

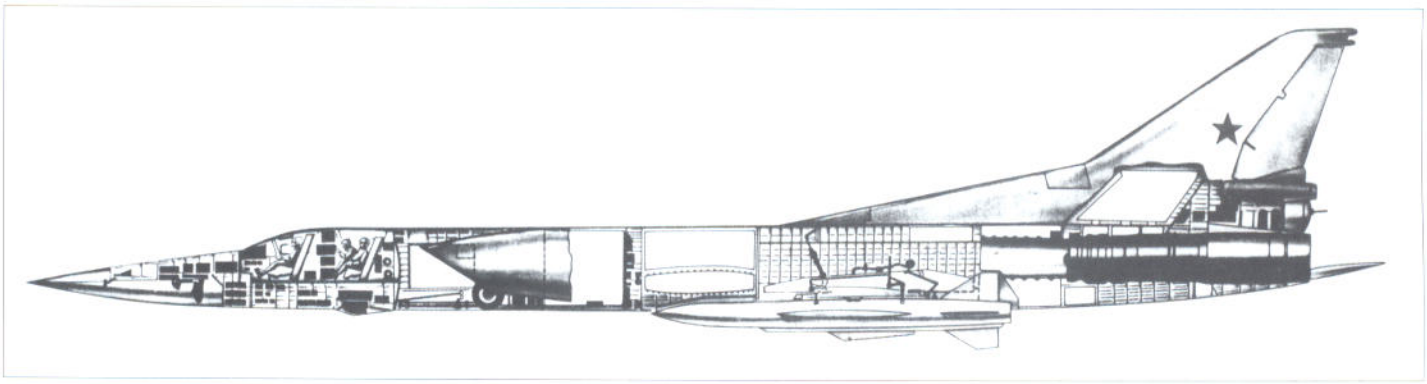
Below, left: **Detail view of the cockpit of a Tu-22M2.**

Below, right: **Tu-22M2 rear cockpit.**
All Yefim Gordon

Bottom: **Tu-22M3 fuselage sectional drawing.**
Yefim Gordon archive

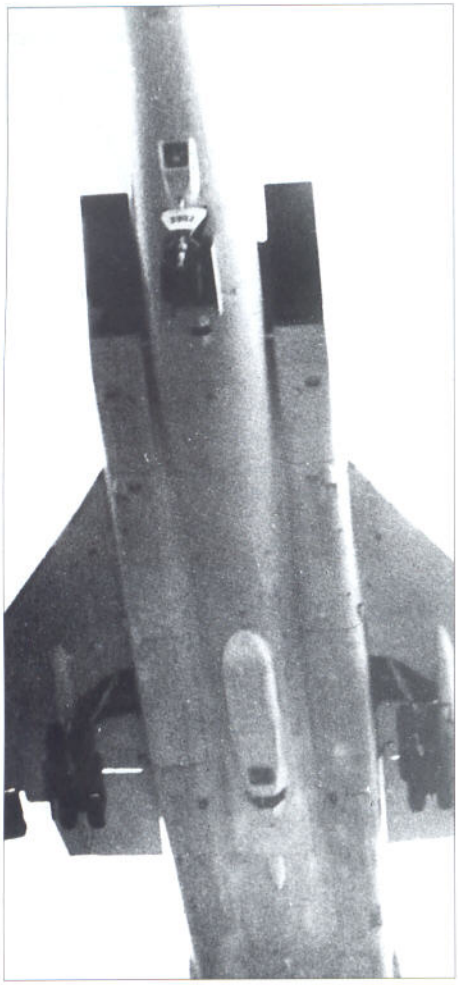






Tu-22M 'Backfire' family specifications

	Tu-22M0		Tu-22M1		Tu-22M2		Tu-22M3	
First flight	1969		1971		1973		1977	
Powerplant	2 x NK-144-22		2 x NK-22		2 x NK-22		2 x NK-25	
Rating in full afterburner	2 x 196kN	2 x 44,091lb st	2 x 196kN	2 x 44,091lb st	2 x 196kN	2 x 44,091lb st	2 x 245kN	2 x 55,114lb st
Length with refuelling probe	41.46m	136ft 0.2in	41.46m	136ft 0.2in	41.46m	136ft 0.2in	42.46m	139ft 3.65in
Wing span – maximum	31.6m	103ft 8.09in	34.28m	112ft 5.6in	24.28m	112ft 5.6in	34.28m	112ft 5.6in
– minimum	22.75m	74ft 7.67in	25.0m	82ft 0.25in	25.0m	82ft 0.25in	23.3m	76ft 5.32in
Wing area – maximum	183.58m²	1,974ft²	183.58m²	1,974ft²	183.58m²	1,974ft²	183.58m²	1,974ft²
– minimum	175.8m²	1,890.32ft²	175.8m²	1,890.32ft²	175.8m²	1,890.32ft²	175.8m²	1,890.32ft²
Wing leading edge sweep	20° to 60°	20° to 60°	20° to 60°	20° to 65°				
Take-off weight	121 ton	266,754lb	122 ton	268,959lb	122 ton	268,959lb	124 ton	273,368lb
Top speed	1,530km/h	950mph	1,660km/h	1,031mph	1,800km/h	1,118mph	2,300km/h	1,429mph
Range, subsonic	4,110km	2,553sm	5,000km	3,106sm	5,100km	3,169sm	n/a	n/a
Combat radius	n/a	n/a	n/a	n/a	2,200km	1,367sm	2,200km	1,367sm
Service ceiling	12,000m	39,370ft	12,000m	39,370ft	12,600m	41,338ft	13,300m	43,635ft
Take-off run	2,600m	8,530ft	2,300m	7,546ft	2,300m	7,546ft	2,100m	6,889ft
Landing run	1,130 to 1,450m	3,707 to 4,757f	1,130 to 1,450m	3,707 to 4,757ft	1,130 to 1,450m	3,707 to 4,757ft	1,200 to 1,300m	3,937 to 4,265ft
Crew	4		4		4		4	
Payload	n/a	n/a	12 ton	26,455lb	24 ton	52,910lb	24 ton	52,910lb

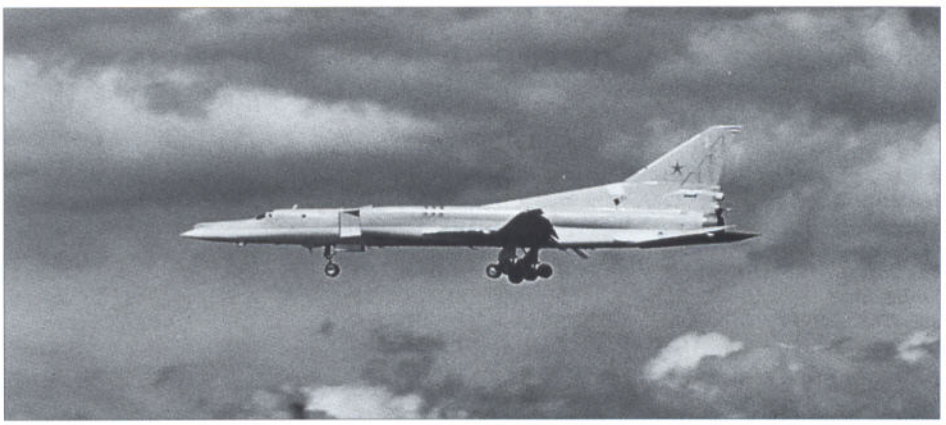


Top: **Heavy maintenance underway on a Tu-22M3 at Shaikovka.** Yefim Gordon

Above, centre: **Retired and stripped out Tu-22M2 at Shaikovka.** Yefim Gordon

Left: **Belly details of the first prototype Tu-22M3R.** Victor Drushlyakov

Bottom: **Probe-less Tu-22M2 on approach to Zhukovsky.** Yefim Gordon



'Backfire' in Colour

Above and right: **Tu-22M0 'Red 41' in the snow at the Air Force engineering school, Irkutsk.** Yefim Gordon

Below: **'Blue 33', a Tu-22M0 at the Monino museum.** Yefim Gordon

Photographs on this page, all by Yefim Gordon

Top: **Detail view of the cockpit of a Tu-22M2.**

Centre: **Tu-22M2 line-up at Shaikovka with 'Red 07' in the foreground.**

Bottom: **Tu-22M2 'Red 07' at Shaikovka.**

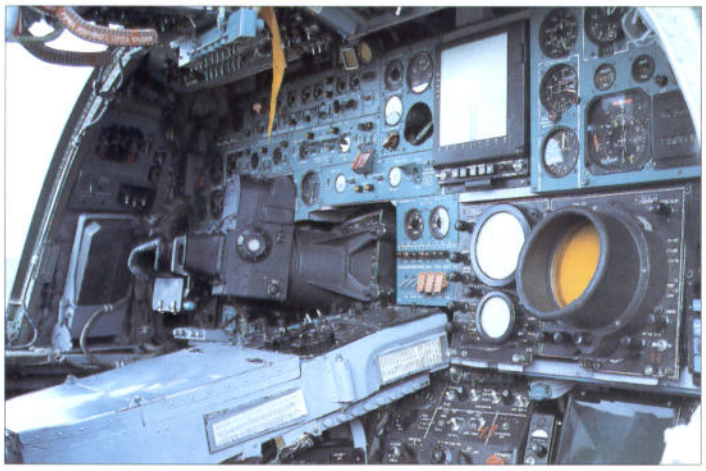
Photographs on the opposite page:

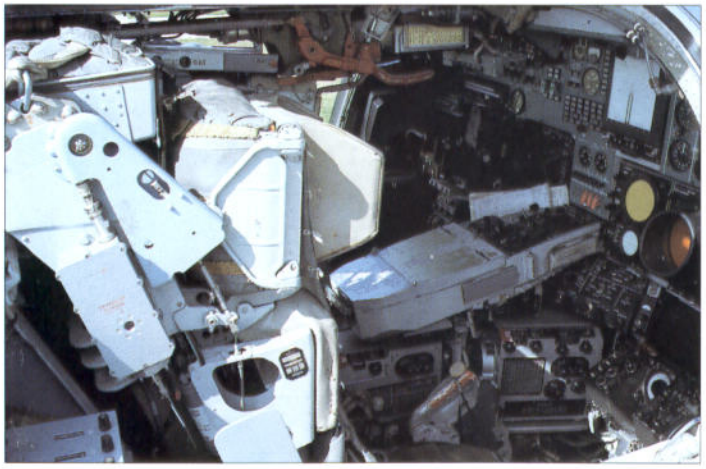
Top: **Tu-22M3 in a dispersal, Shaikovka.**

Centre left: **Tu-22M2 rear cockpit.**

Right: **Close-up of the rear of a Tu-22M2.**

Bottom left: **Another view of the rear cockpit of a Tu-22M2, showing ejection seat details.** All Yefim Gordon





Photographs on this page:

Top: **The second prototype Tu-22MR (or Tu-22M3R) 'Red 36'.** Victor Drushlyakov

Centre: **Test-bed Tu-22M3 'Red 32' at MosAero '92, Zhukovsky.** Yefim Gordon

Below: **Improved Tu-22M3 'Black 4504'. Note the 12 blow-in doors on the mid-fuselage, instead of the usual nine.** Yefim Gordon

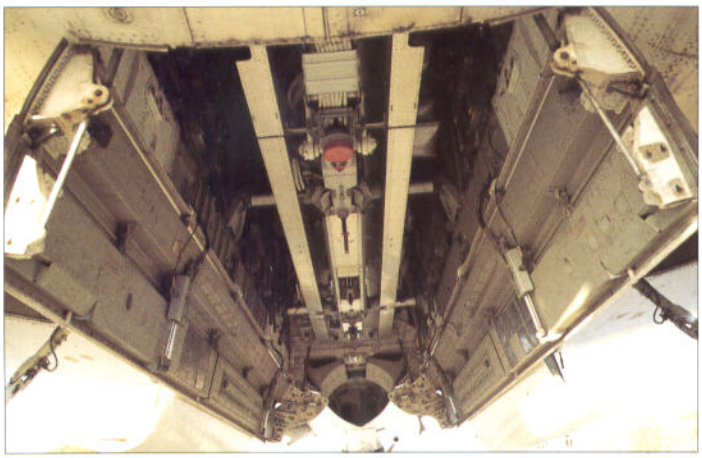
Photographs on opposite page:

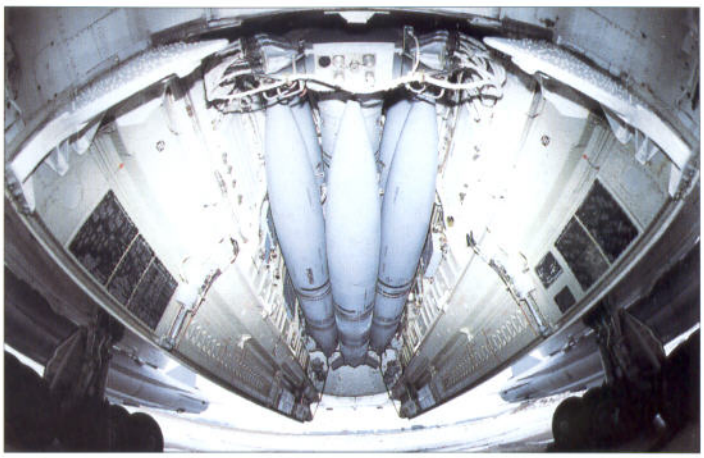
Top: **Tu-22M3s 'Red 03', '57', '15', '44'? and '10', and Tu-154 RA-85614, at Ostrov.**

Centre, left: **View of the cockpit of '57' (ex '31'?) Tu-22M3 at Ostrov.**

Centre, right: **Detail of a Naval Aviation Tu-22M3 cockpit.**

Bottom: **Tu-22M3s at dispersal, Shaikovka.** All Yefim Gordon





Photographs on this page:

Above, left: **Bomb bay of a Tu-22M3 in 'conventional' weapon guise.** Yefim Gordon

Above: **Bomb bay of a Tu-22M3 with a rotary launcher for six Kh-15 missiles.** ITAR-TASS

Left: **Rear view of a Kh-22P anti-radar missile.**

Below, left: **NK-25 engine on maintenance trolley.**

Bottom: **Kh-22P anti-radar missile.**

Below: **A Kh-22M missile semi-recessed in the bomb bay of a Tu-22M3.** All Yefim Gordon

Photographs on the opposite page:

Top: **Tu-22M3 'Black 9804' carrying a pair of Kh-22Ms.** Tupolev OKB

Centre: **Another angle of a Kh-22M missile.**

Bottom: **Line-up of Tu-22M3s at Engels.**
Both Yefim Gordon

Three views of Tu-22M3 'Red 10' at the Naval Aviation Centre, Ostrov, 1997. All Yefim Gordon

Changing the Guard

Crew briefing in front of a Kh-22 equipped Tu-22M3. Note the 'all-weather' maintenance gantry with furled canvas covers and the Tu-160 'Blackjacks' in the background.
Sergei Skrynnikov

As mentioned earlier, the Long Range Aviation's (DA's) 42nd Combat Training Centre at Dyaghilevo airbase took delivery of two Tu-22M0 prototypes in February 1973, thus marking the beginning of the 'Backfire's' operational career. Incredibly perhaps, air and groundcrew at Dyaghilevo received their type ratings in just 20 days – this was helped a lot by prior training at the Tupolev OKB, LII and the Kazan plant.

Assistance from Tupolev, LII and various design bureaux responsible for the Tu-22M's systems proved invaluable in making it operational. The two aircraft began flying practice sorties in March. On 5th June the same year a Tu-22M0 gave a spectacular demonstration of firepower to Soviet government officials and military leaders, knocking out a group of tanks and armoured personnel carriers with 500kg (1,102lb) GP bombs. The bomber's captain, Boris G Podchinyonov, received a wristwatch with an engraved commendatory inscription (no mean reward in those days) and was later awarded the Order of the Red Star – one of the highest decorations for gallantry.

As soon as the qualified flying instructors (QFIs) at Dyaghilevo had become familiar with the Tu-22M they started training crews from units which were to convert to the type. Production-standard 'M2s were delivered in the spring of 1974; a month later a crew from Dyaghilevo made the first live launch of a Kh-22.

The 'Backfire's' service entry was far less troublesome than that of the 'Blinder' because all of its systems, particularly the control system, had many of the predecessor's bugs designed out of them. The Tu-22M had much better field performance, which again facilitated conversion training.

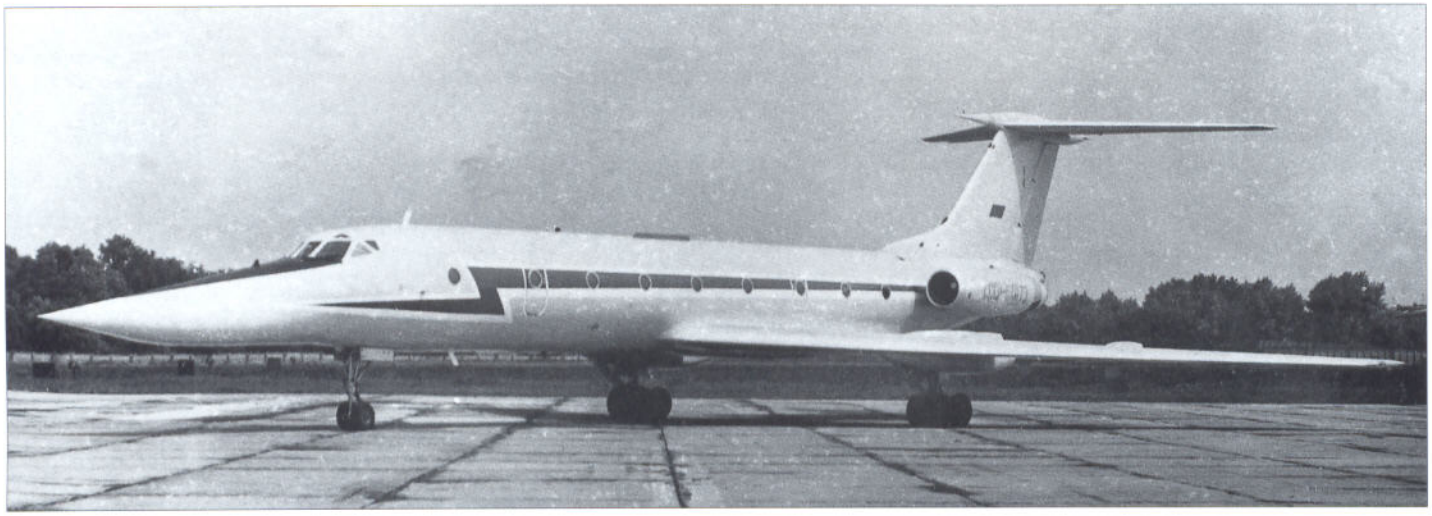
Gradually DA and Naval Aviation (AV-MF) units re-equipped with the Tu-22M. Starting in 1982, 'Backfire' pilots took their training at Engels and Tambov on the Tupolev Tu-134UBL (oochebno-boyevoy dlya lyotchikov – combat trainer for pilots), a purpose-built derivative of the Tu-134B 'Crusty' short/medium-haul three-jet airliner. Its *raison d'être* was that, unlike the 'Blinder', the Tu-22M had no dedicated trainer version; the Tu-134B was picked because it was very similar in thrust-to-weight ratio and field performance to the 'Backfire'.

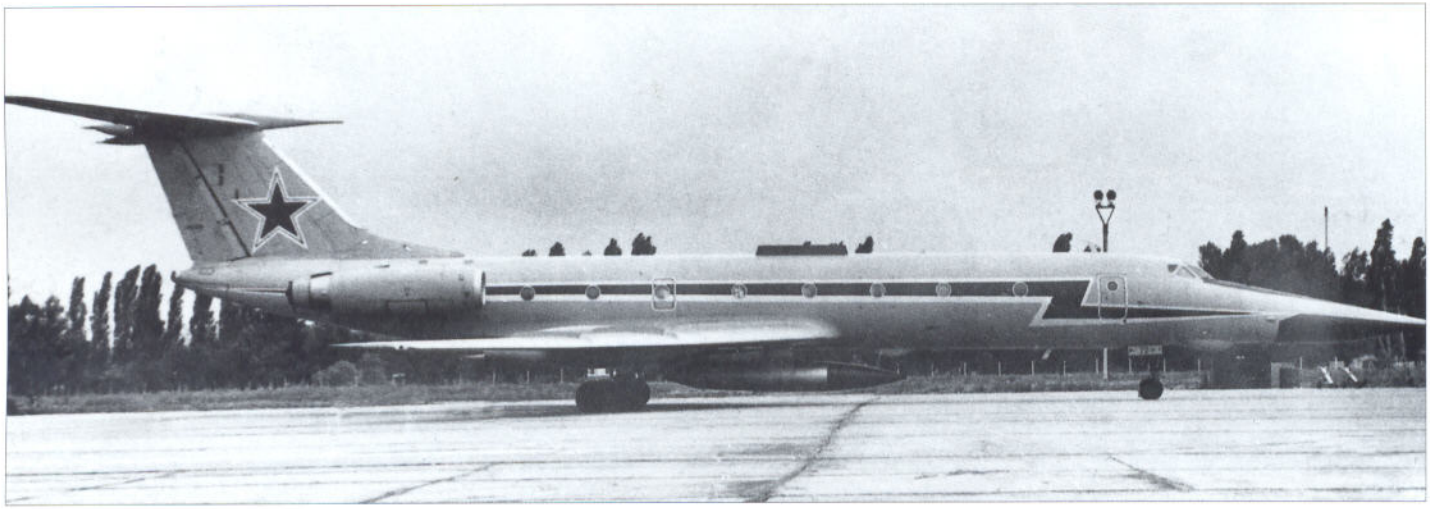
The Tu-134UBL had a Tu-22M3 'Pinocchio nose' (albeit housing an ROZ-1 weather radar borrowed from the Tu-134A) grafted on ahead of the flight deck and featured Tu-22M instrument panels so that trainees could get used to the view from the cockpit. Twelve trainees were carried, taking turns flying the aircraft from the right hand seat.

Navigators were trained in Voroshilovgrad on the older Tu-134Sh-1 (Shtoormanskiy), a navigator trainer based on the Tu-134A. This had 13 trainee stations, MERs for practice bombs under the centre section and a nav suite similar to that of the 'Blinder', including astro-sextant and RBP-4 'Roobin-1Sh' radar.

An advanced version of the Tu-134UBL, designated Tu-134UBK, was developed in 1982 for naval 'Backfire' crews. It had a PNA radar in the nose, a chin-mounted ROZ-1 weather radar, an OPB-15T bombsight at the wing leading edge and a fixed Kh-22 acquisition round further aft. The aircraft remained a one-off, as plant No.135 in Kharíkov had switched to the Antonov An-72/An-74 'Coaler' transport by the time trials were completed. The sole Tu-134UBK ('Red 72') went to the 3rd naval combat training centre in Nikolayev (Ukraine).

To save wear and tear on the new bombers, naval units converting to the Tu-22M2 initially retained a single squadron of Tu-16K-26 'Badger-G Mod' or Tu-16K-10-26 'Badger-C Mod' missile carriers for proficiency training. New mission types were included in the training routine to reflect the greater capabilities of the 'Backfire'. These included long range missions using the navigation suite, flight refuelling (on





Top: **The one-off Tu-134UBL crew trainer, wearing its civil registration CCCP-64073.**

Above: **'Red 72', the sole Tu-134UBK advanced crew trainer for naval Tu-22M3 crews – note the underslung pod.** Both Tupolev OKB archive

one occasion during the test programme an 'M2 stayed airborne for more than ten hours), high speed/low level missions and weapons training.

Between July and September 1974, five 'M2s were delivered to the 185th GvBAP at Poltava in the Ukraine. The unit had previously operated the 'Badger' and, before that, the Tu-4 'Bull' (reverse-engineered Boeing B-29 Superfortress). In 1976 a group of 185th GvBAP 'M2s demonstrated the type's capabilities in low level high speed formation flight. The unit's commanding officer was none other than Pyotr S Deynekin who went on to become Colonel General and Commander-in-Chief (C-in-C) of the Russian Air Force and, in August 1997, Hero of Russia (the modern equivalent of the Hero of the Soviet Union title).

Deliveries to the naval air arm began a year earlier when a number of Baltic Fleet and Black Sea Fleet units switched from the Tu-16K-10-26 to the Tu-22M2. The 'Backfire's' long range, high speed, stealthy low level approach capability and heavy armament made it a potent adversary to NATO carrier groups which were the Soviet Navy's prime targets.

AV-MF strike groups going for a carrier group were organised so that at least seven aircraft had a chance to score a hit on the carrier. A single Kh-22M could tear a 20m² (215ft²) hole in a ship's side and burn its way 12m (39ft) in, demolishing internal bulkheads; thus, the carrier would almost certainly go down before the attackers were destroyed. For even greater efficiency they worked in concert with Tu-95RT 'Bear-D' (razvedchik-tseleookazahteli) Elint/over-the-horizon (OTH) target designator aircraft and Tu-16P 'Badger-H' and 'Bear-J' passive/active ECM aircraft. They could also set up minefields in the path of enemy convoys.

Logically enough, the 'M2 was the first version of the 'Backfire' to be revealed to the public. Photographs of the aircraft appeared in newspapers and magazines in 1980 during a major Warsaw Pact military exercise, 'Brahtstvo po orouzhiyu-80' (Comradeship-in-arms '80). Naval Tu-22M2s based at Bykhovo mined the Baltic straits to keep 'Blue Force' warships out and supported 'Red Force' marines capturing a beachhead. Despite a full ordnance load the bombers went so fast that the MiG-23M 'Flogger-B' fighter escort could not keep up with them! (In Russian war games, 'Red Force' are the 'good guys' and 'Blue Force' are the 'bad guys'; in the West it is vice versa.)

However, the beginning of the Tu-22M's career was marred by a poor reliability record. The 'Backfire's' systems were fairly complex and had their share of problems. Ground crews, too, had trouble with maintenance procedures and often made mistakes at the beginning of the learning curve, damaging the aircraft. The result was one of the lowest mean time between failures (MTBF) rates in the Soviet Air Force which earned the Tu-22M2 the uncomplimentary nickname of 'Vsepogodnyy Defektonosets' – 'all-weather defect carrier'! In its defence, this can be said for any new weapon system in any country.

Engine life was initially a mere 50 hours and the manufacturer was forced to impose a limit on exhaust gas temperature, thus limiting the NK-22's thrust. The engine was also plagued by excessive vibration and sometimes literally shook itself to pieces. Leaky hydraulics were another source of annoyance; often the 'M2 returned to base with the aft fuselage covered in hydraulic fluid and mechanics had to start scouring and scrubbing. Rivets began popping and fatigue cracks appeared after low level high speed missions.

Avionics failures and electromagnetic interference problems were common in the early

days. The automatic flight control system (AFCS) sometimes failed, leaving the pilots no choice but to fly manually all the way home. The BD-45F pylon had a quirk - if a missile was carried on the centreline station the co-pilot had to check with the WSO that the missile was in the 'up' position before cycling the undercarriage, otherwise the main gear doors would damage the missile's wings.

A minor inconvenience was associated with the landing gear itself. The mainwheel brakes had electric cooling fans using three-phase constant frequency AC. This could only be supplied by the APU and the crew had to remember to start it up before landing.

Gradually the Tu-22M2 took up residence on both sides of the Ural mountains, replacing the Tu-16 and Tu-22 in front-line service. Despite the initial bugs, the type was well liked by the aircrews; besides, Tupolev, Kuznetsov and other bureaux involved with the 'Backfire' worked hard to eliminate the shortcomings and the aircraft kept improving.

The DA's combat training centre received its first Tu-22M3s in March 1981. That same year the type attained initial operational capability (IOC) with the 185th GvBAP at Poltava. In 1985 the unit's pilots gave a startling demonstration of the bomber's defence penetration capabilities, flying a high speed low level mission in tight formation. The 'Troyka' turned out to be far less troublesome than its precursor, earning a good reputation with DA and naval crews alike.

New tactics were developed for the Tu-22M to increase its combat potential. Covertly approaching the target at ultra-low level, the 'Backfire' received guidance from Ilyushin/Beriev A-50 'Mainstay' AWACS aircraft and airborne command posts (ABNCPs), with Sukhoi Su-27 'Flanker-B' and MiG-31 'Foxhound' interceptors flying top cover. Incidentally, the latter type can operate as a 'mini-AWACS' in its own right, thanks to its powerful Phazotron SBI-16 'Zaslon' (barrier) radar.

The 'Backfire' proved to be a rugged aircraft. In September 1986 a Tu-22M3 on short finals had a malfunction resulting in uncommanded retraction of the flaps at 30m (98ft). As lift suddenly diminished the aircraft 'fell through' all the way to the ground. Reacting instantly, the captain selected full afterburner and the bomber made an unscheduled but spectacular 'touch and go' short of the runway, ploughing 100m (330ft) furrows in the ground. When it landed safely a few minutes later, a wing, a stabiliser and the landing gear had been badly bent by the impact, but the aircraft remained flyable and returned to service after the damaged airframe components had been replaced.

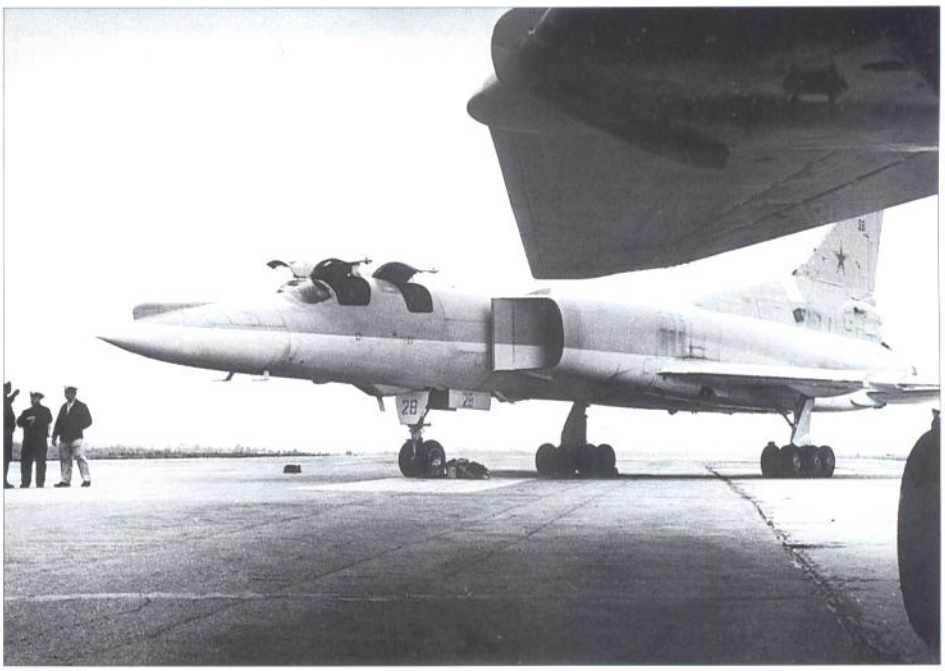
As of this writing, 380 Tu-22M2s and 'M3s are in service with the CISAF, forming the backbone of the heavy bomber force and naval air arm. They operate from bases in Russia, Belorussia and the Ukraine.

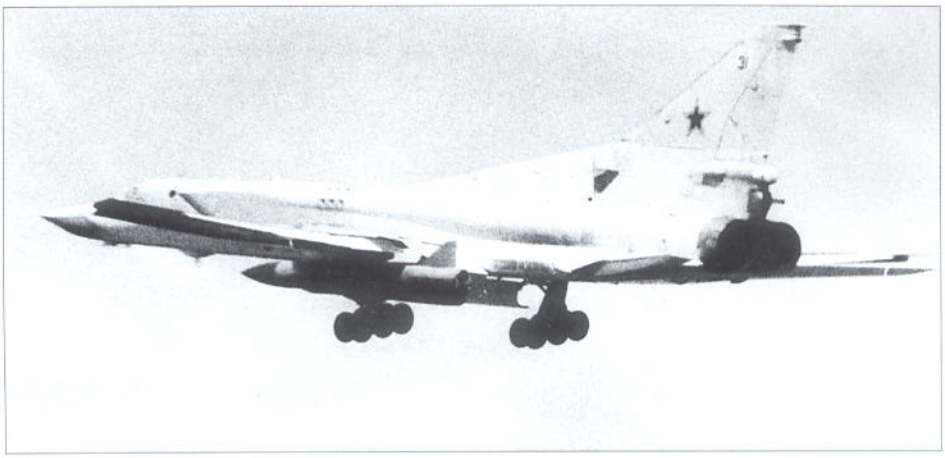
The Tu-22M3 received its baptism of fire in the Afghan war, flying strike missions against Mujahideen rebels. In December 1987-January

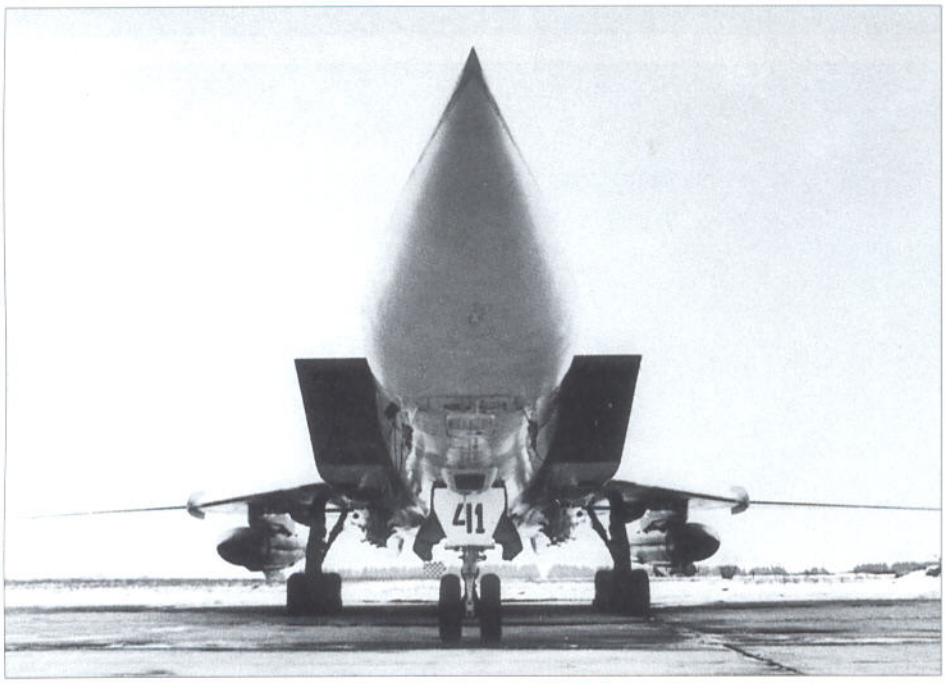
Top: **Tu-22M3 with large fin-code '12' (or '2') and all four weapons pylons installed.** Yefim Gordon

Above: **Tu-22M3 with with a Kh-22 on the starboard outer pylon. Some censorship appears to have been applied to the extreme nose.** Sergei Skrynnikov

Below: **Tu-22M2 '28' in Naval Aviation service.** Yefim Gordon archive







Left and below: **Two views of Tu-22M3s ('31' and '41') carrying a pair of Kh-22M missiles. The airborne view shows how the missile fin protrudes aft of the 'Backfire's trailing edge.**
Both Yefim Gordon archive

Current Tu-22 and Tu-22M operators in 'European' CIS 46th VA (Air Army), DA

Unit	Location	On strength
121st TBAP	Machulischchi AB, Minsk, Belorussia	34
185th GvBAP	Poltava, Ukraine	22
200th TBAP	Bobruysk, Russia	20
203rd TBAP	Baranovichi, Belorussia	32
260th TBAP	Stryy AB	20
341st TBAP	Ozyornaya AB, Zhitomir, Ukraine	30
2nd AD (Air Division), Black Sea Fleet		
5th TBAP	Vesyolaya AB*	20
943rd TBAP	Oktyabriskaya AB	23

* For the record, this translates as 'Merry Base'!

1988 the Soviet Army began a major operation to relieve the besieged city of Khost. This called for massive air support, so two squadrons of 185th GvBAP 'Backfire-Cs' were sent from Poltava to Maryy-2 airbase in Turkmenistan near the Afghan border.

Usually the Tu-22M3s bombed Mujahideen fortifications, bases and materiel dumps, but on one occasion they were called to the rescue when the rebels trapped a Soviet Army unit in a canyon. The bombers came in in line abreast formation across the canyon and delivered a tremendous punch, dropping the bombs simultaneously as commanded by LORAN. About 200 ton (440,917lb) of bombs were delivered in that strike, with an accuracy margin of about 100m (328ft).

The Tu-22M3's next Afghan mission came in October 1988 when the Soviet Union was pulling out of the war-torn country. To discourage the Mujahideen from attacking 40th Army's mechanised infantry units, a group of 16 'Backfires' flew an unprecedented number of sorties. At least 12 aircraft were in the air at once. The 'Backfires' bombed not only rebel camps and groups but also mountain passes and any avenues of approach which the enemy could have used, causing numerous avalanches and rendering the roads impassable. 500kg (1,102 lb) GP bombs were followed by 1,500kg (3,306lb) and 3,000kg (6,613lb) bombs which, as eyewitnesses recounted, 'flattened the mountains completely'.

Night sorties were also flown to keep the Mujahideen guerrillas from regrouping and preparing for strikes against the leaving Soviet troops. The bombers also hit supply convoys coming in from Iran and Pakistan. Night missions involved carpet bombing; one such mission resulted in the total destruction of the city of Gerat. The 'M3's final Afghan missions were flown in January 1989 in the notorious Salang pass, the scene of bitter fighting throughout the war where many Russian soldiers died.

The bombers flew high enough to keep out of range of Mujahideen air defences, especially portable US-built Stinger shoulder-launched surface-to-air missiles, and not a single Tu-22M3 was lost or damaged during the war. In recognition of their services, many of the 'Backfire' crews taking part in the 'Afghan tour' received combat orders and medals.

In 1984 the 184th TBAP, based at Priluki in the Ukraine, and a former 'Badger' operator, re-equipped with Tu-22M3s. However, they were but a stepping stone to the Tu-160 'Blackjack' which the unit was ultimately to fly. This 'intermediate type' strategy worked well, easing the transition from Tu-16 to Tu-160, since the 'Backfire' and 'Blackjack' have a lot in common, including supersonic speed, variable geometry and cockpit layout.

Unfortunately, nearly all Tu-22Ms and surviving Tu-22s found themselves outside Russia as the Soviet Union disintegrated. Their fate now depends a lot on the political wisdom of the leaders of the new CIS republics.

The demise of the USSR took its toll on the aerospace industry and hence the serviceability of the civil and military aircraft fleet. Many types, including Tu-22Ms, are grounded. Russian AF C-in-C Colonel General Deynekin listed expired certificates of airworthiness, spares shortages and severance of economic ties among the republics as some of the factors keeping the aircraft on the ground.

Ukrainian Tu-22M3s based at Poltava and Priluki are grounded by fuel shortages and lack of spares (political differences between Russia and the Ukraine are probably a contributing factor to the latter), and the Ukrainian Air Force has repeatedly suggested placing them in storage until the situation improves. Some nations outside the CIS, particularly Iran and China, have expressed an interest in the 'Backfire-C' but the USA has warned Russia strongly against delivering the bombers to these customers which, putting it mildly, are not exactly pro-American.

The 'Backfire's' prospects are not so bleak after all. The scrapping of various strategic and tactical missile systems may turn the Tu-22M3 into both an effective and highly practical means of pre-emptive strike – that is, if the aircraft receives a systems upgrade and new high accuracy weapons.

Throughout its 20-year development and service history the Tu-22M went the long and winding road from a proposed simple 'Blinder' upgrade to a completely unrelated aircraft. It was a major milestone for both Tupolev, the Kazan factory and the Soviet aerospace industry at large. For the first time in aircraft design history, a variable geometry heavy bomber had been designed within a very brief period.

The appearance of 'Backfire' led the USAF to issue a requirement resulting in the Rockwell (now Northrop Grumman) B-1A Lancer. Conversely, Tu-22M experience paved the way for the Tu-160 - the Soviet answer to the B-1A.

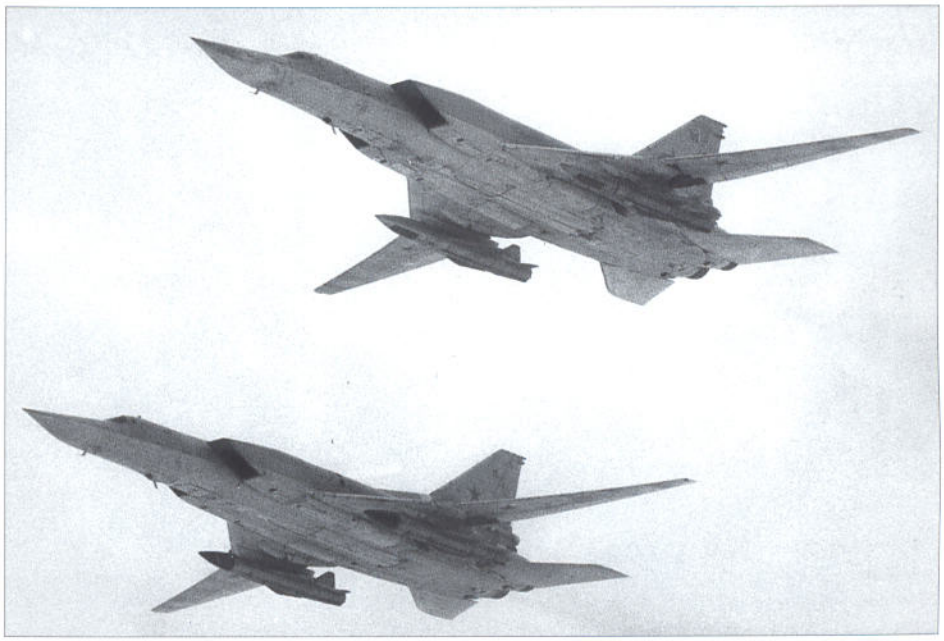
The West learned of the Tu-22M's existence in 1969 from intelligence reports supplemented later by satellite imagery. However, graphic information on the aircraft released in the West was guesswork (as usual) until the first good air-to-air shots of Tu-22M2s intercepted over the North Atlantic were available in 1973.

As the Tu-22M was similar in size to the B-1, Western defence analysts consistently called it a strategic aircraft with intercontinental strike capability. Hence the 'Backfire' repeatedly became a trump card in negotiations between the East and the West. Finally, the USSR agreed to place the type outside the strategic category in keeping with the SALT-2 strategic arms limitation treaty.

To comply with the treaty, Tu-22M2s and early Tu-22M3s had their refuelling probes removed, and late production Tu-22M3s were delivered probeless. Thus the Tu-22M became a tactical bomber with a huge payload; range as declared at the SALT-2 talks was a mere 2,000km (1,242sm) while the ordnance load reached 24 ton (52,910lb). Furthermore, a 30 aircraft per year limit was imposed on 'Backfire' production.

The type's first public display was in August 1988 when a Tu-22M3 took part in the Aviation Day flypast at Tushino; the 'Backfire' has been a regular participant of these events ever since. On 14th April 1992, it put in an appearance at the Kubinka-92 'open-doors' day. In August 1992 the Tu-22M3LL ('Red 32', c/n 4830156, f/n 3005) graced the static park at MosAeroShow '92 and the Tu-22M3/NK-32 test-bed ('Black 4504', c/n 2145345, f/n 4504) took part in the flying display. In September same year a 'M3 with no tactical code appeared at the Farnborough International '92 airshow in the UK. Despite remaining in the static park for the duration, the 'Backfire' stole the show simply by making the type's first visit to the West.

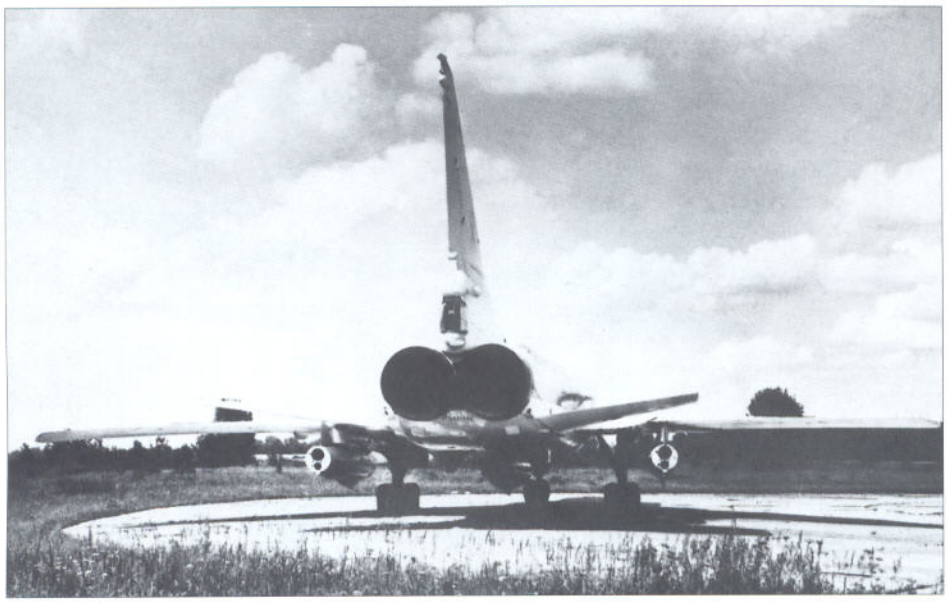
'Black 4504' was flying again at the MAKS-93 airshow in Zhukovsky, while a standard late-production Tu-22M3 ('Red 60', c/n 3791834, f/n 9103) was in the static display. MAKS-95 featured 'Black 4504' in the static park and a sister ship operated by LII ('Black 9804', c/n 4898649, f/n 9804) in the flying display. This latter was in the static display at MAKS-97 (19th-24th August 1997), carrying an MER with nine GP bombs under the port wing and under the starboard wing a dummy Kh-22.



Top: **'No.31', a Tu-33M3 carrying Kh-22. An Il-76 and a pair of Tu-160s in the background.**
Yefim Gordon archive

Centre: **Two Tu-22M3s, '95' carrying Kh-22Ms (right) and '15' with Kh-22Ps, left.**

Above: **Probeless Tu-22M2, 'Red 49'.**
Both Yefim Gordon



New generation supersonic missile carrier project (Tu-22M derivative)

While improving the basic Tu-22M, the Tupolev OKB was working on a far more ambitious project which was but distantly related to the 'Backfire'; in fact, it was far closer to the Lockheed SR-71 Blackbird. The aircraft featured a blended wing/body design with two NK-25 engines in widely-spaced nacelles blended into the wings and twin fins atop the nacelles. Unlike the SR-71, however, the wings still had variable geometry and the main gear units retracted into the engine nacelles rather than inwards. The Tu-144 'Charger' had been nicknamed 'Concordski' in the West, implying that it was 'a copy of the Concorde' (which of course was not true). Had the new generation aircraft been built it would undoubtedly have been dubbed 'Blackbirdski'!

Once again the project was much too radical; a complete change of manufacturing tooling and a lengthy test programme would have been needed. Both the VVS and the factory said no, and the project was killed at the preliminary design stage.

Top: **Rear view of a Kh-22 equipped Tu-22M3.** Tupolev OKB

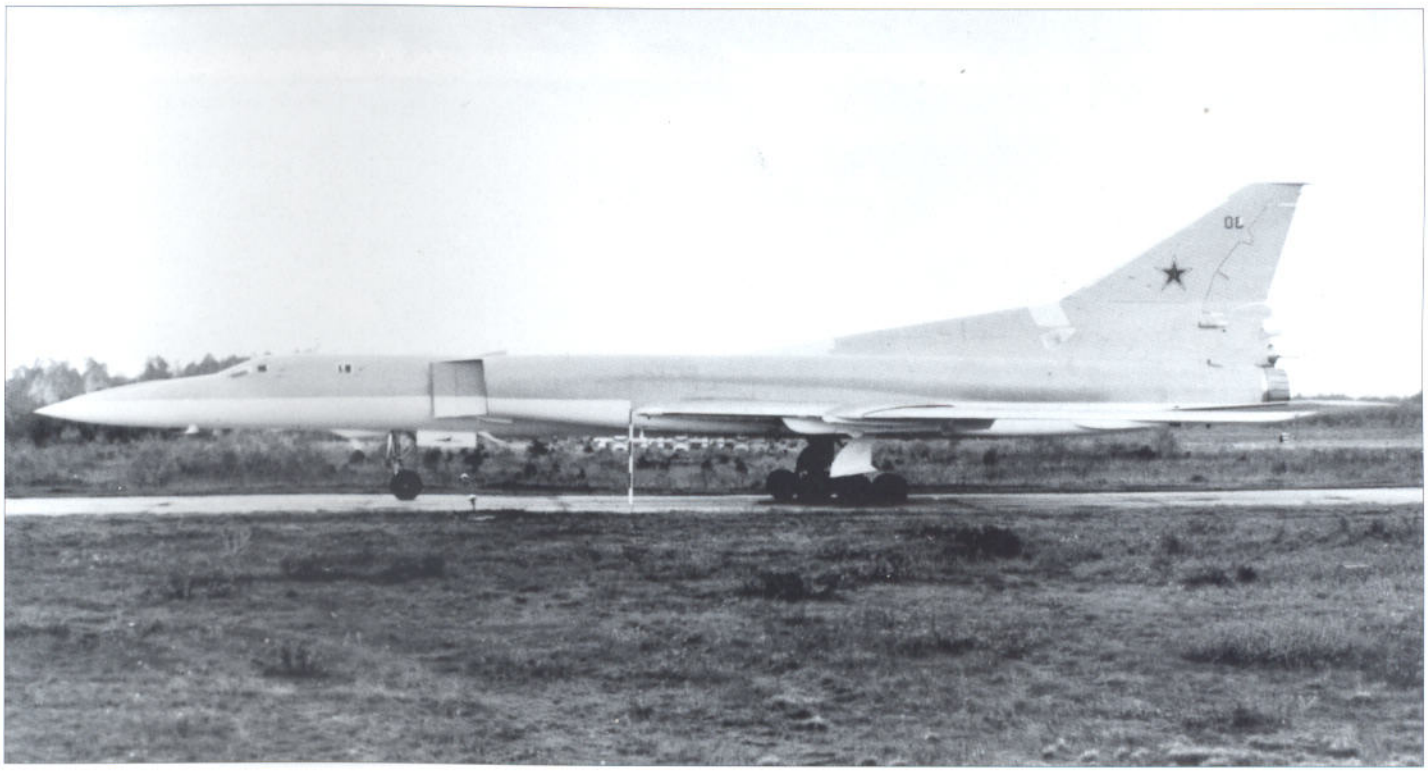
Left: **Crews preparing for flight in front of Tu-22M3 'Red 57' at Ostrov. The starboard nosewheel door shows signs of overpainting, possibly taken from another aircraft ('31' ?) acting as a spares source.** Yefim Gordon

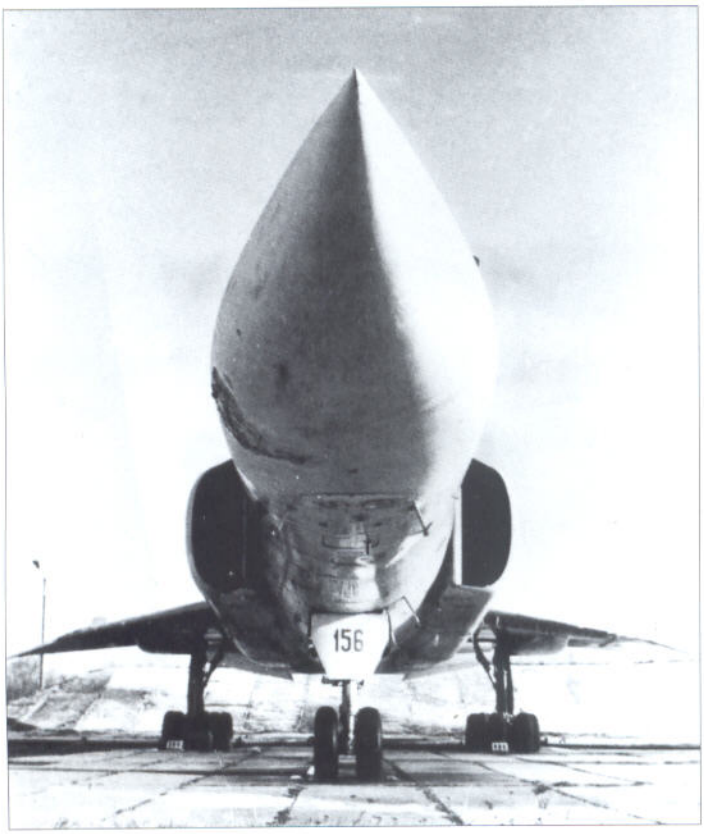
Below: **Line-up of Tu-22M3s, 'Red 15', '44' and '10' at Ostrov, 1997. The starboard nosewheel door of 'Red 15' has a row of four red stars adjacent to its stencilled number.** Yefim Gordon

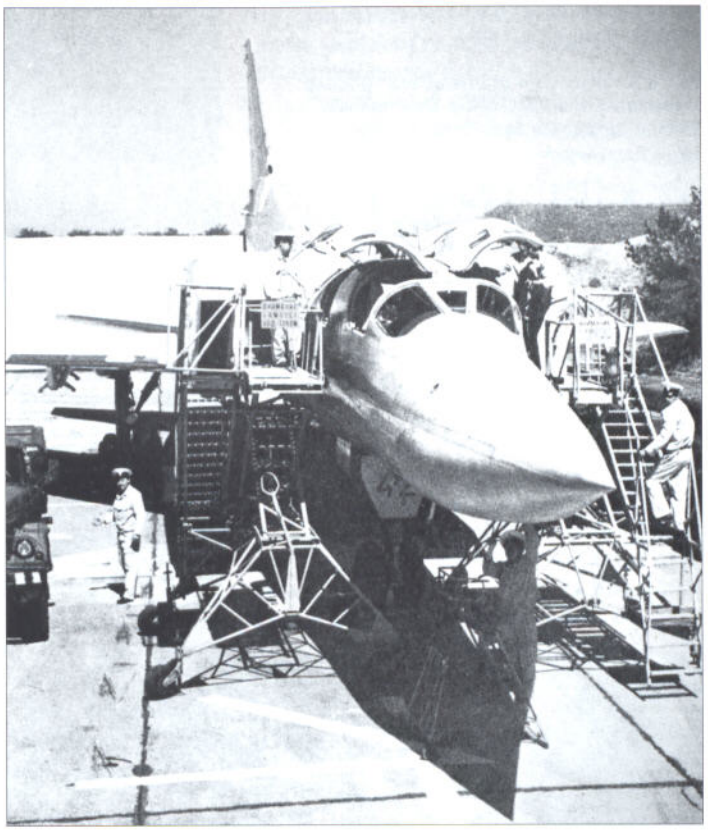
Top: **'156', one of the ten T-22M0s.** Aviatsiya i Vremya magazine

Centre: **Another view of one of the Tu-22M0 prototypes, 'Blue 33', at the Monino museum. Blinder '32' can be seen in the background.** Sergei Popsuyevich

Bottom: **Port side profile of '08', an early Tu-22M2. Note the logo on the nosewheel door. See also pages 58 and 59.** Yefim Gordon collection







Photographs on this page:

Above: **Nose view of Tu-22M0 '156', taken at the Kiyev Military Academy.** Aviatsiya i Vremya magazine

Above, right: **Access gantries around Tu-22M3 '42'.** Yefim Gordon archive

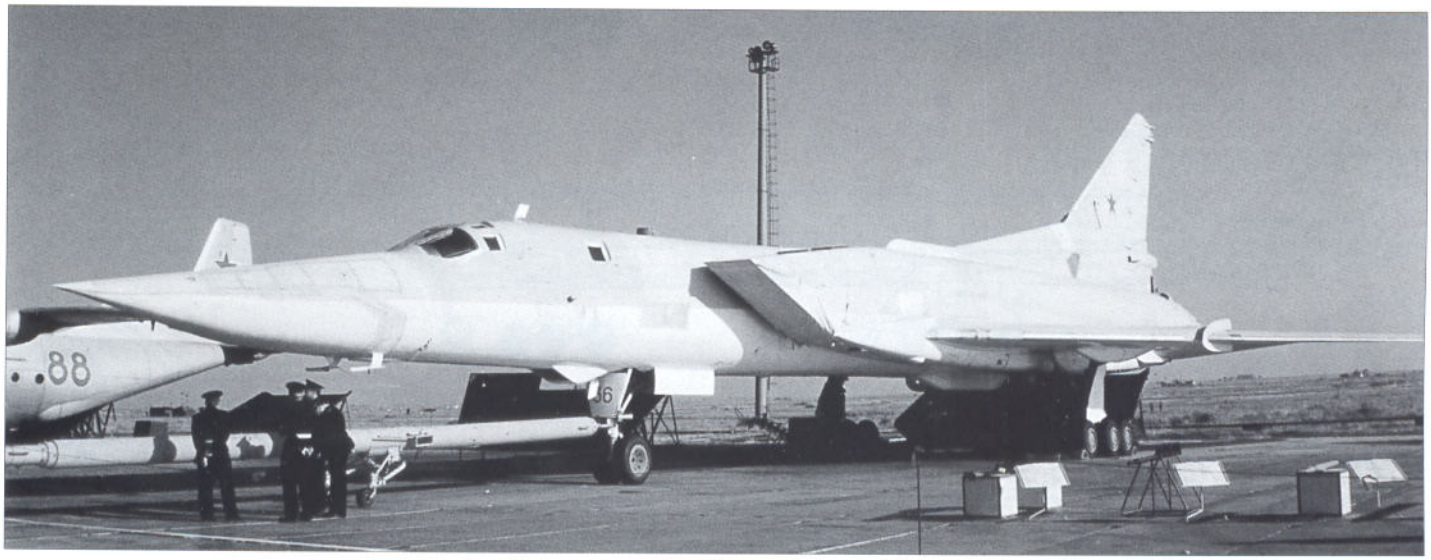
Below: **Tu-22M3 '30' providing good detail of the under nose aerials.** Yefim Gordon

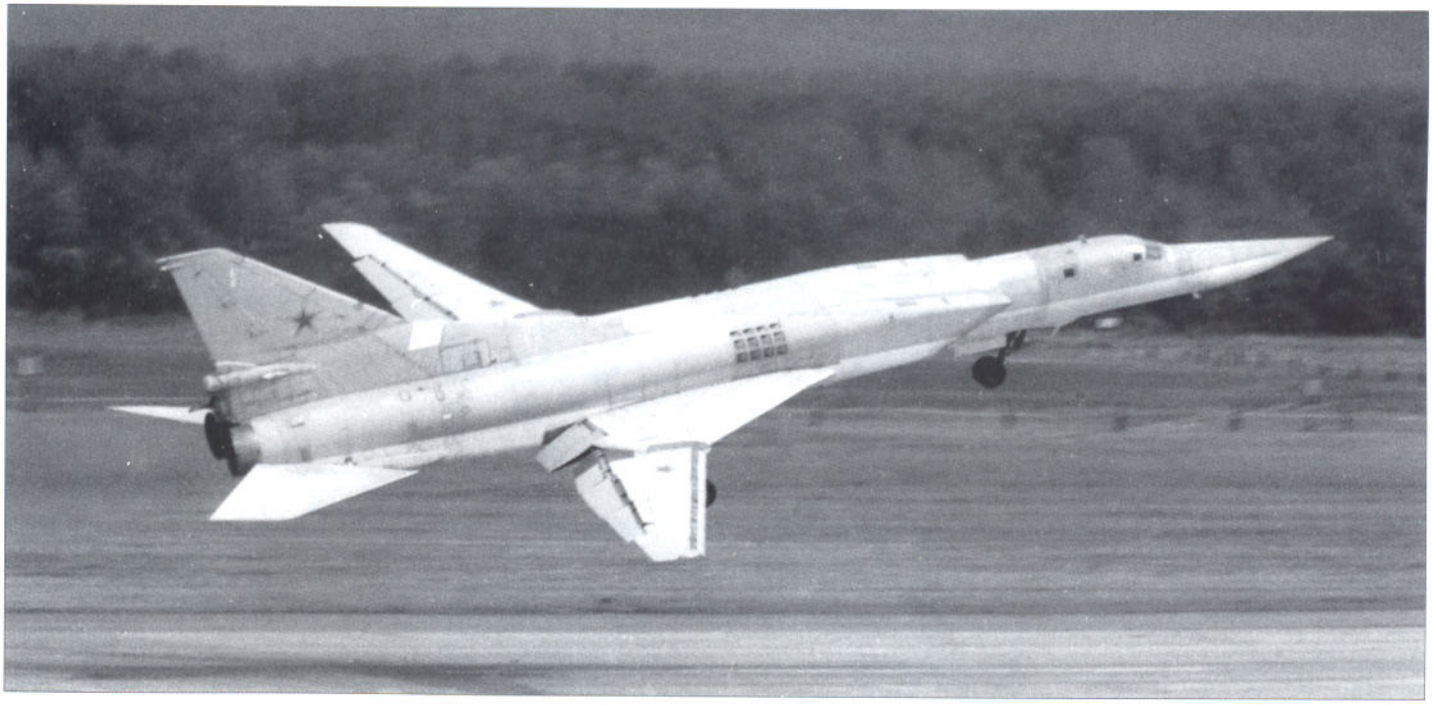
Photographs on opposite page:

Top: **Late production Tu-22M3 'Black 9804' used by LII at Zhukovsky.** Yefim Gordon

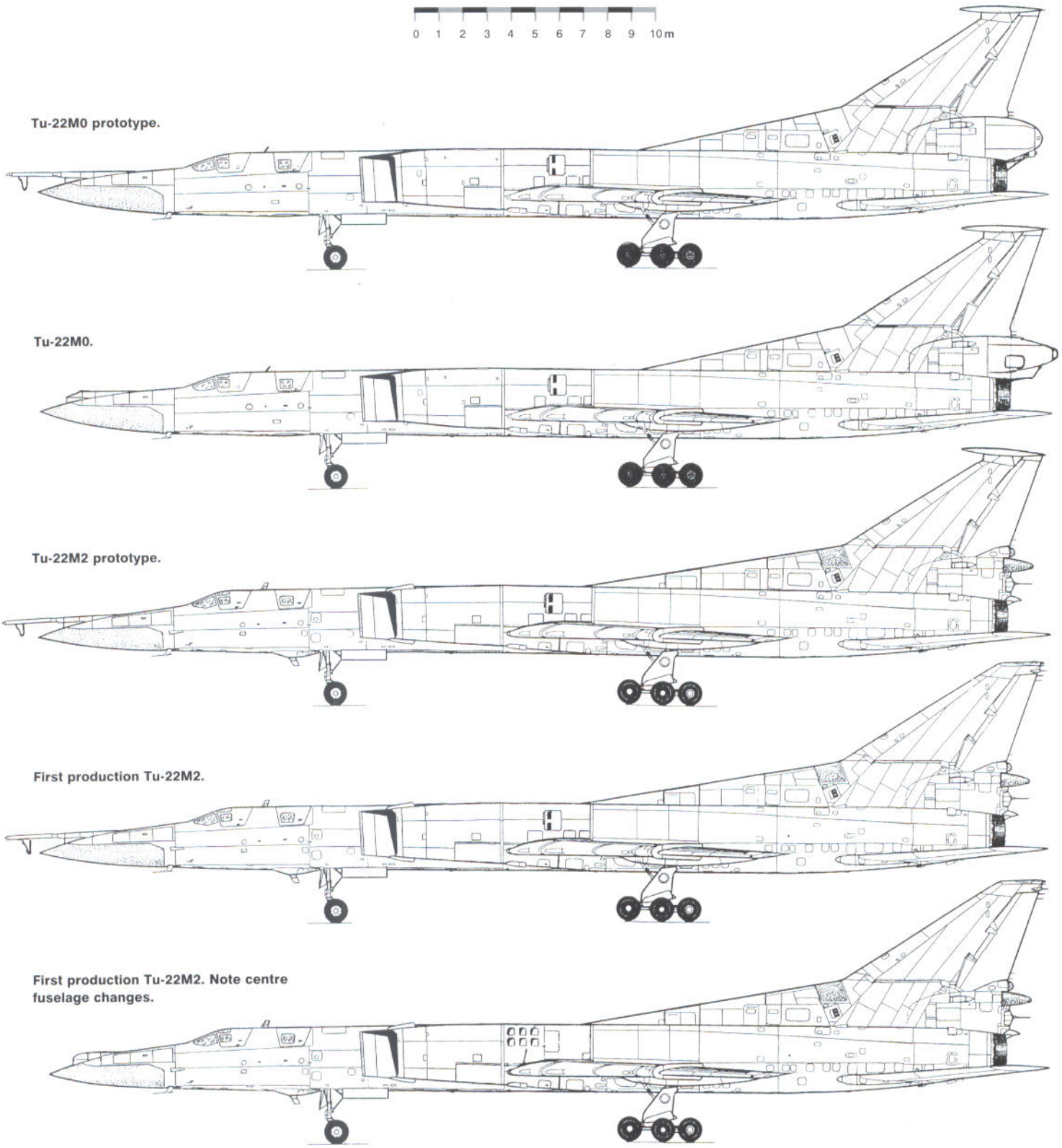
Middle: **Tu-22M3R 'Red 36' at Akhtoobinsk.** Sergei Sergeyev

Bottom: **Tu-22M3 'Black 4504' going through its paces.** Yefim Gordon





'Backfire' in Profile



Tu-22M0 prototype.

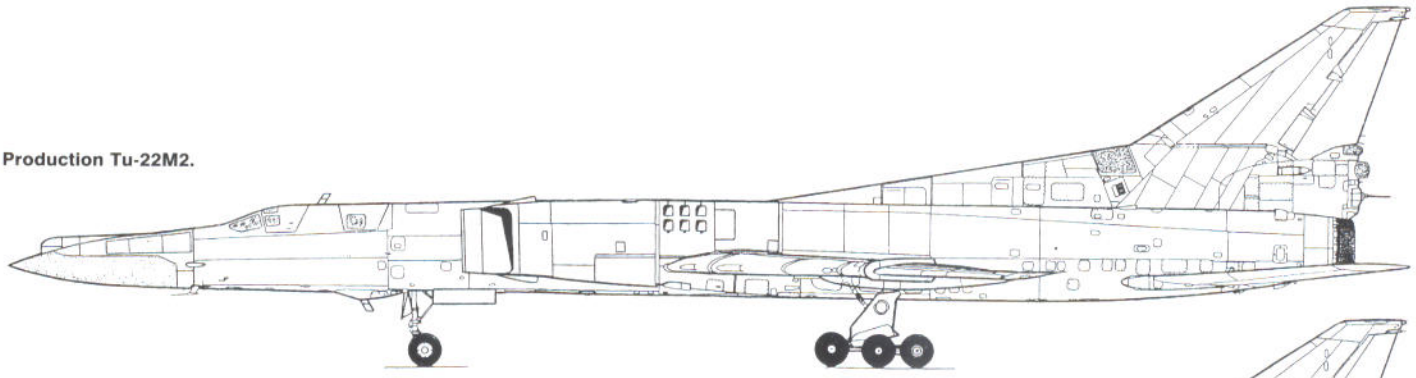
Tu-22M0.

Tu-22M2 prototype.

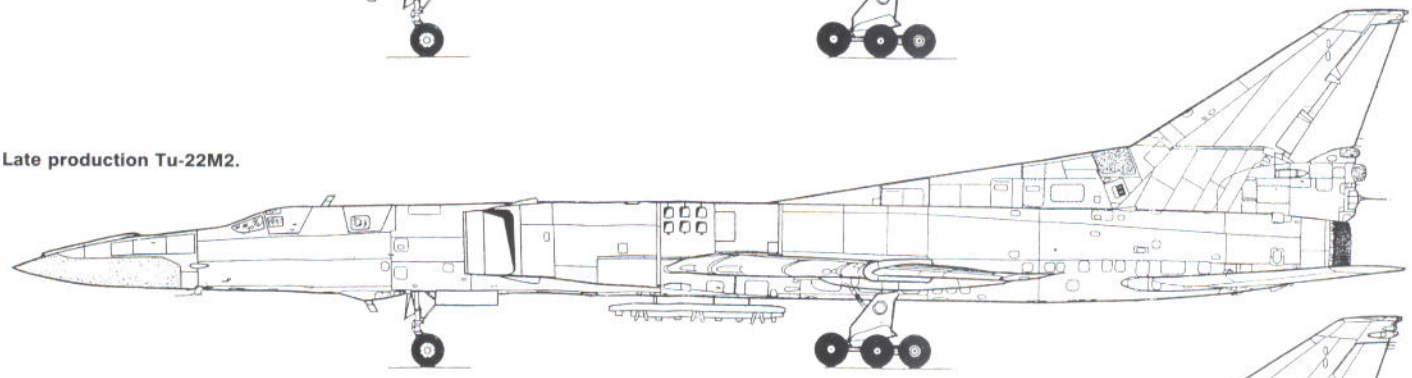
First production Tu-22M2.

First production Tu-22M2. Note centre fuselage changes.

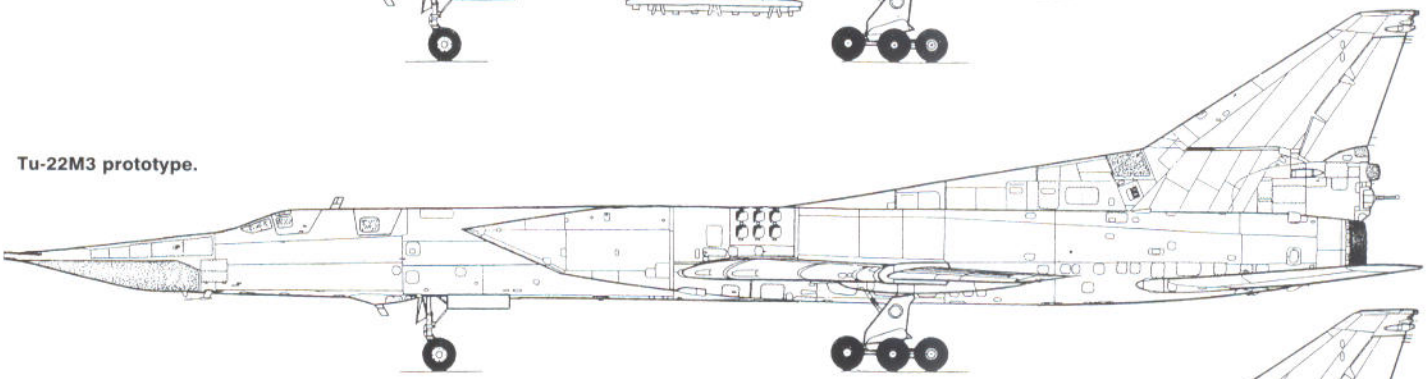
Production Tu-22M2.



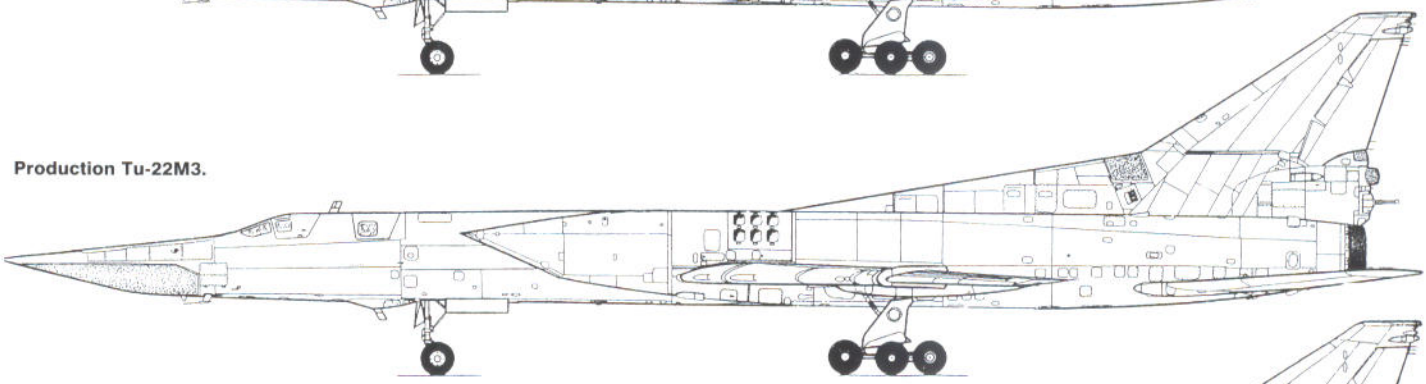
Late production Tu-22M2.



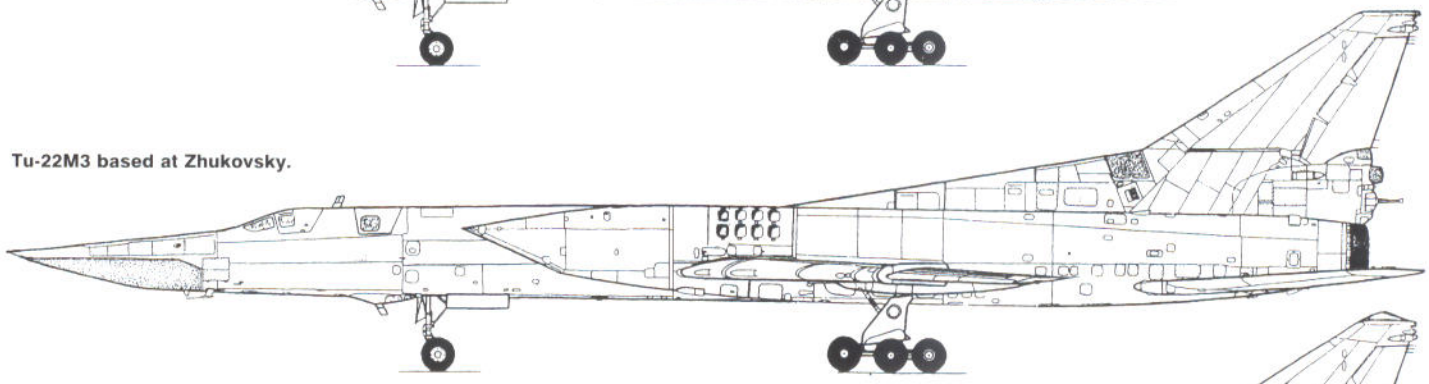
Tu-22M3 prototype.



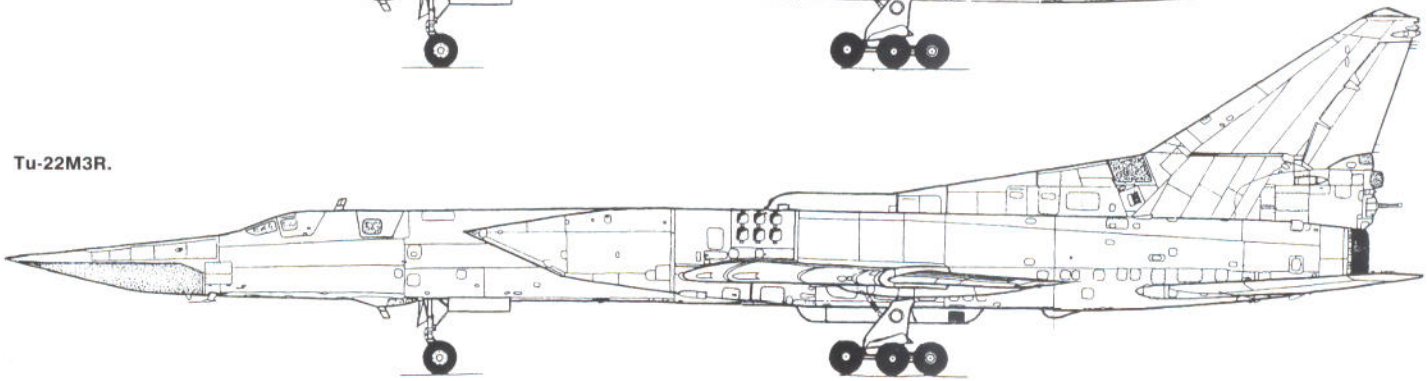
Production Tu-22M3.

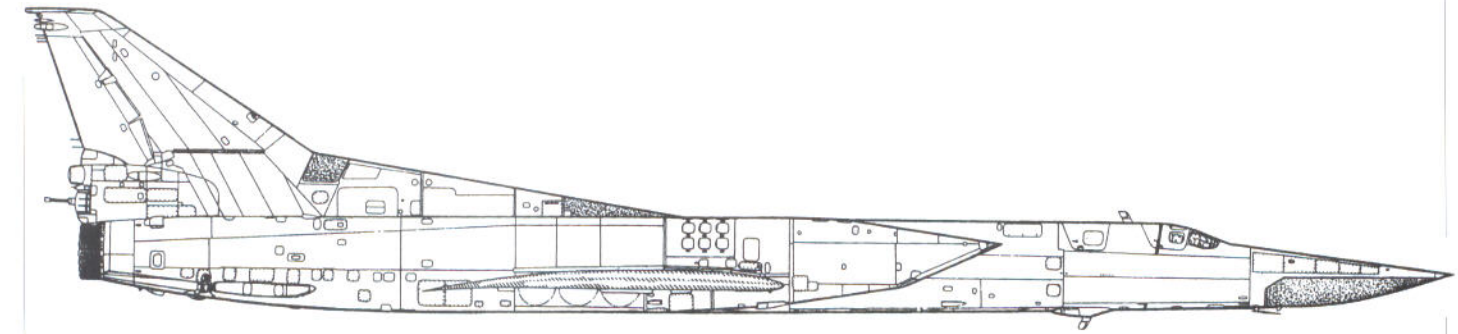


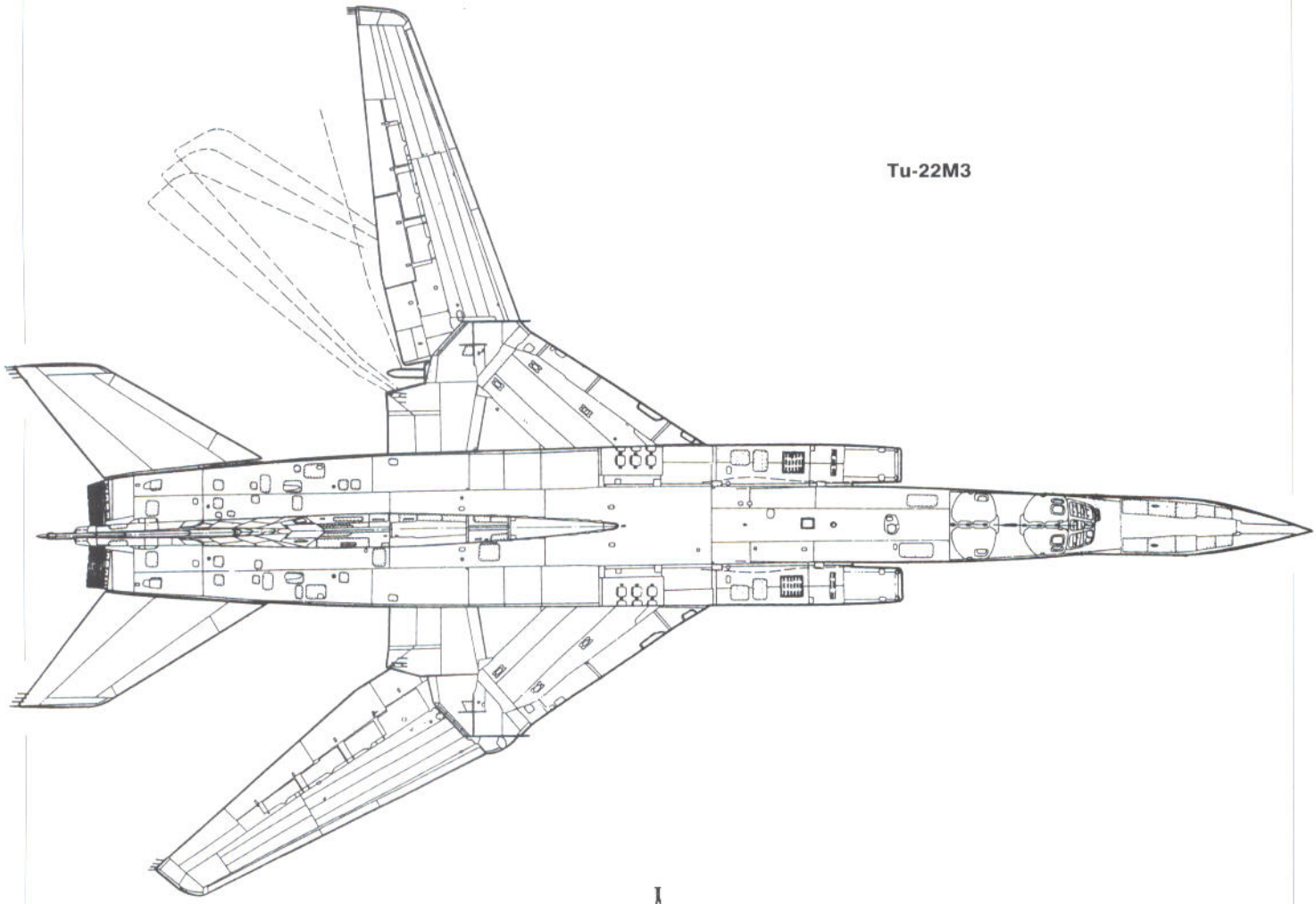
Tu-22M3 based at Zhukovsky.



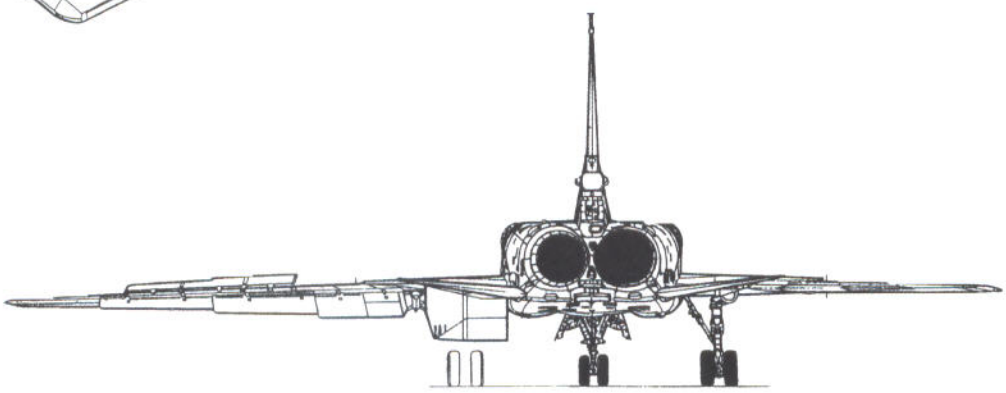
Tu-22M3R.

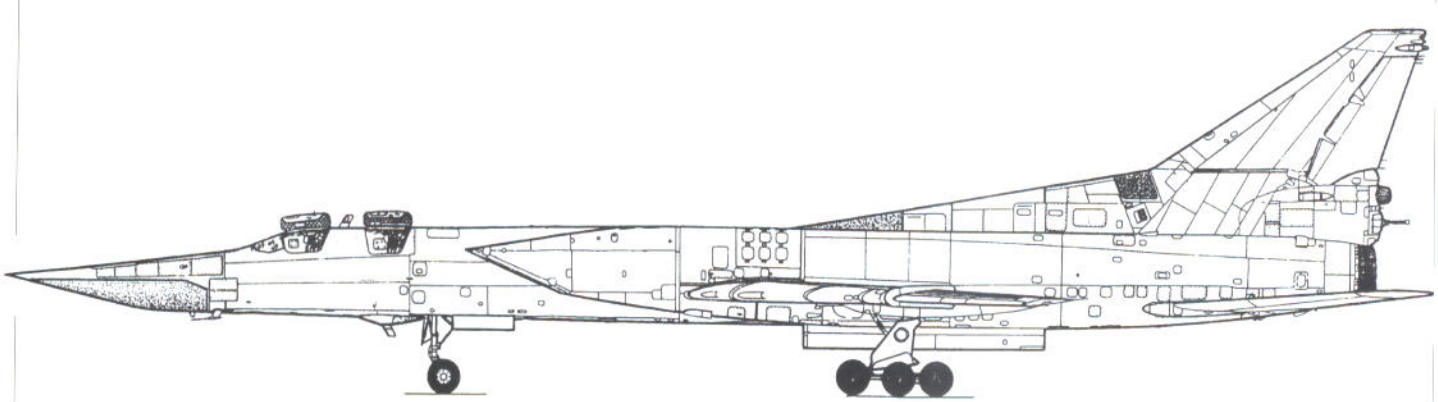






Tu-22M3





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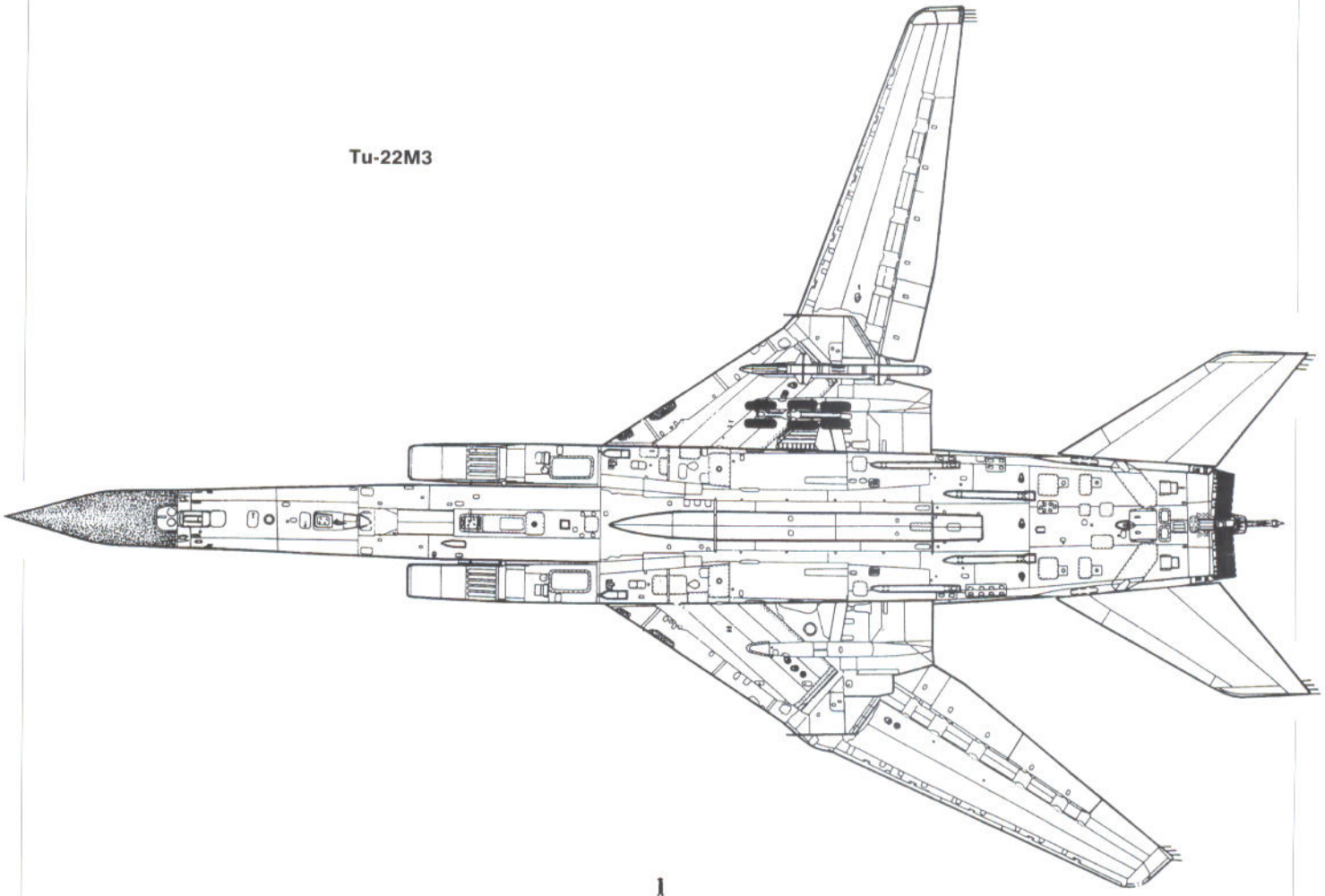

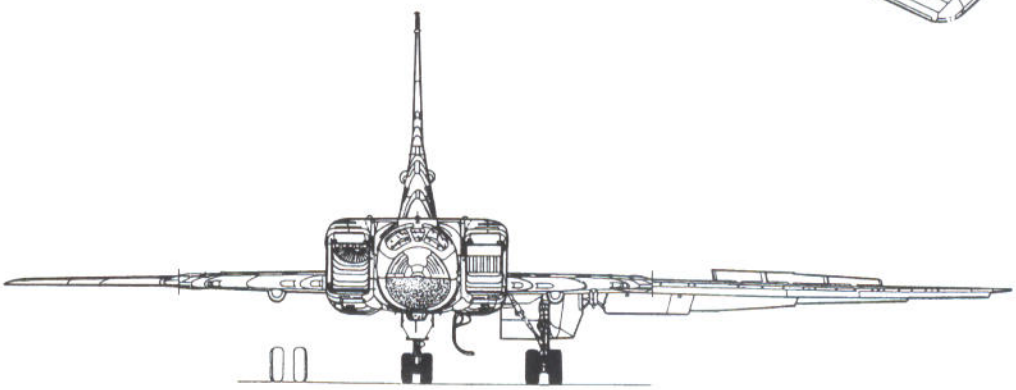

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OKB SUKHOI
A history of the design bureau and its aircraft

Vladimir Antonov et al, with Jay Miller

A team of authors have thoroughly documented the products of this famous Soviet aircraft design bureau, thanks to extensive access to the company records and photo files. A huge amount of unpublished information and illustrations are included. Each aircraft type is reviewed in detail, also prototypes, testbeds and projects, some of which never saw the light of day. Appendices detail test pilots and major personalities.

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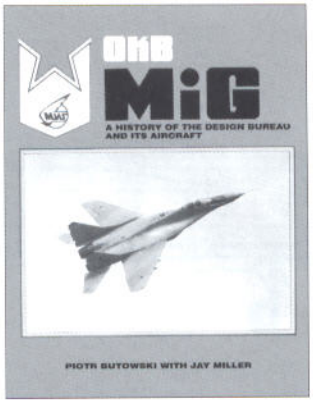
OKB MiG
A history of the design bureau and its aircraft

Piotr Butowski, Jay Miller



Beginning with a comprehensive overview of Soviet military aviation, the text methodically moves from the births of Mikoyan and Gurevich through to the founding of the MiG design bureau during 1939, its war years, and the period of greatest importance, beginning with the advent of the MiG-15 and the Korean War and continuing via the MiG-17, -19, -21, -23, -25 and -27 to the MiG-29 and MiG-31 era. A highly acclaimed work.

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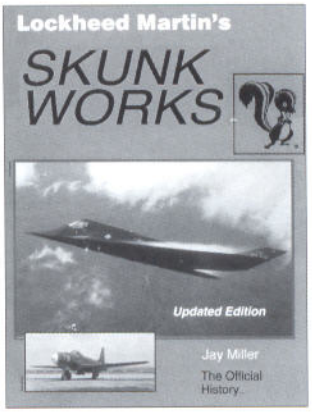

An updated edition of the original 1994 book – written with the co-operation of Lockheed Martin's Advanced Development Company. In a major 'pulling back' of the veil of secrecy, official histories of such products as the P80, RB-69, T-33, F-94, F-104 and CL-400, right the way through to the U-2, A-12, D-21, SR-71, and F-117, are finally brought to light.

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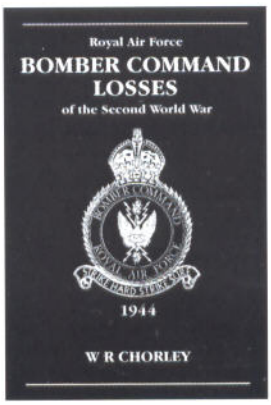

A series to cover the whole war, day-by-day, identifying units, aircraft, crews and the circumstances behind each European Theatre loss. Appendices include loss totals by group, squadron and aircraft type for each year; bases by group, bomber OTU losses by unit and type, PoWs, escapers etc. This series makes an ideal complement to *Bomber Command War Diaries*.

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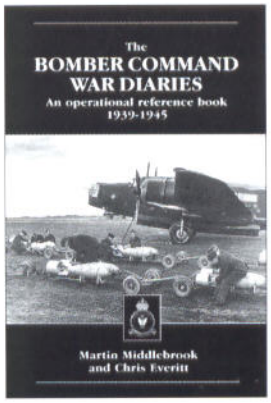
Martin Middlebrook & Chris Everitt



Provides a concisely-worded day-by-day review of each raid . Operational statistics provide unit and group sorties against aircraft lost – which range from 1% through to 18%. Copiously indexed, this is a balanced testament to Bomber Command, its men and rationale. This latest Midland Publishing edition includes minor amendments and new observations, but essentially *War Diaries* continues to be what it has always been, an icon in aviation publishing – the essential classic.

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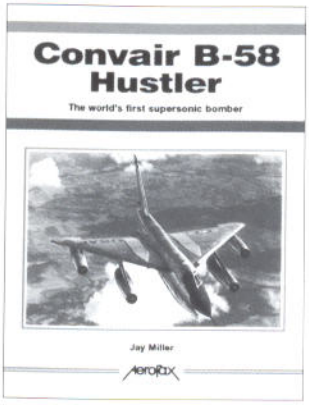
The World's First Supersonic Bomber

Jay Miller



Instantly recognisable with its delta wing and 'coke bottle' area-ruled fuselage the B-58 was put into production for the US Air Force in the 1950s.

First published, in 1985, this is a revised edition, which takes a retrospective in-depth look at this significant aircraft, from design studies, through its development and comparatively short service life, to and beyond retirement. It includes yet more amazing material and 80 new illustrations, bringing the story up to date.

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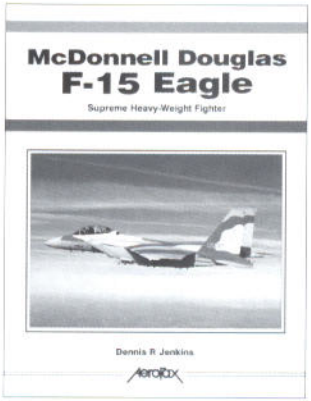
Dennis R Jenkins



The F-15 has held a position of dominance since it entered service with the US Air Force in 1976. Improvement programmes resulted in the F-15C and 'D and it found a whole new lease of life as the 2-seat F-15E 'Strike' Eagle, ground attack aircraft. The F-15 is still in production, under the Boeing banner, meeting export orders from Israel and Saudi Arabia. This completely revised new edition includes in-depth coverage of systems, engines, weapons, and details all operators - past and present.

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Robert S Hoskins III

This book, written by a former USAF RC-135 crew commander, follows the development and service use of this globe-trotting aircraft and its many and varied tasks. Every variant, and sub-variant is charted, the histories of each and every aircraft are to be found within; details of the hundreds of units, past and present, that have flown the Stratotanker are given. This profusely illustrated work will interest those who have flown and serviced them as well as the historian and enthusiast community.

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YAKOVLEV'S V/STOL FIGHTERS

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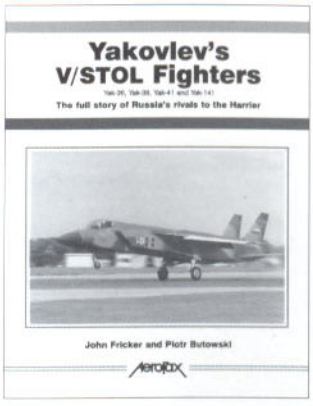

The story of Russia's programme to achieve a supersonic VTOL jet fighter can now be revealed, from the earliest Yak-36 'Freehand' experiments through the carrier-operated Yak-38 'Forger' and astonishing Yak-141 'Freehand', on to the agreement between Yakovlev and Lockheed Martin to help produce JAST, the USA's next generation fighter.

Using material never before seen in the West, this book tells the story of a programme that has to an extent, until recently, been shrouded in secrecy.

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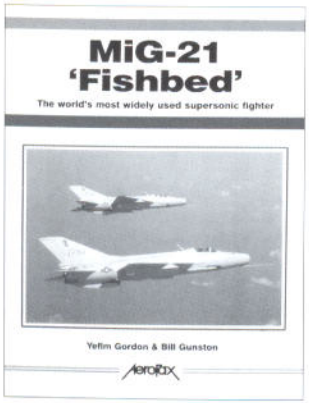
MiG-21 'FISHBED'
Most widely used Supersonic Fighter

Yefim Gordon and Bill Gunston



The ubiquitous MiG-21 is unquestionably one of the greatest fighters of the post-Second World War era. It was Russia's first operational Mach 2-capable interceptor, and a stepping stone for many nations to enter the age of supersonic air combat. Access to the files of the MiG design bureau and other previously inaccessible sources reveal the secrets of the fighter that has flown and fought in more countries than any other supersonic jet.

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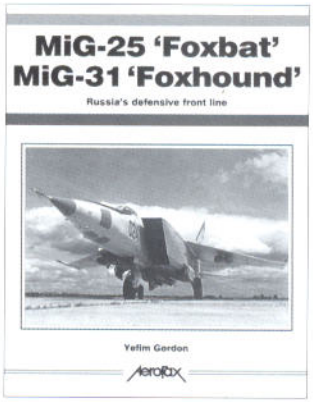

This book takes a detailed, informed and dispassionate view of an awesome aeronautical achievement – the titanium and steel MiG-25 – which became the backbone of the USSR defensive structure. Its follow-on was the similar-looking MiG-31 'Foxhound', very much a new aircraft designed to counter US cruise missiles and in production from 1979. Includes a large amount of previously unpublished material plus extensive and lavish illustrations.

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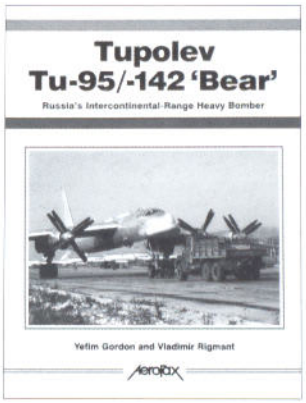
Aerofax
TUPOLEV Tu-95/Tu-142 'BEAR'

Yefim Gordon and Vladimir Rigmant



During the 'Cold War' Tupolev's Tu-95 'Bear' strategic bomber provided an awesome spectacle. It was the mainstay of the USSR's strike force, a reliable and adaptable weapons platform. Additional roles included electronic/photographic reconnaissance and maritime patrol, AEW and command and control.

The author has had unparalleled access to the Tupolev OKB archives, taking the lid off a story previously full of speculation to produce the most comprehensive study to date.

Softback, 280 x 216 mm, 128 pages
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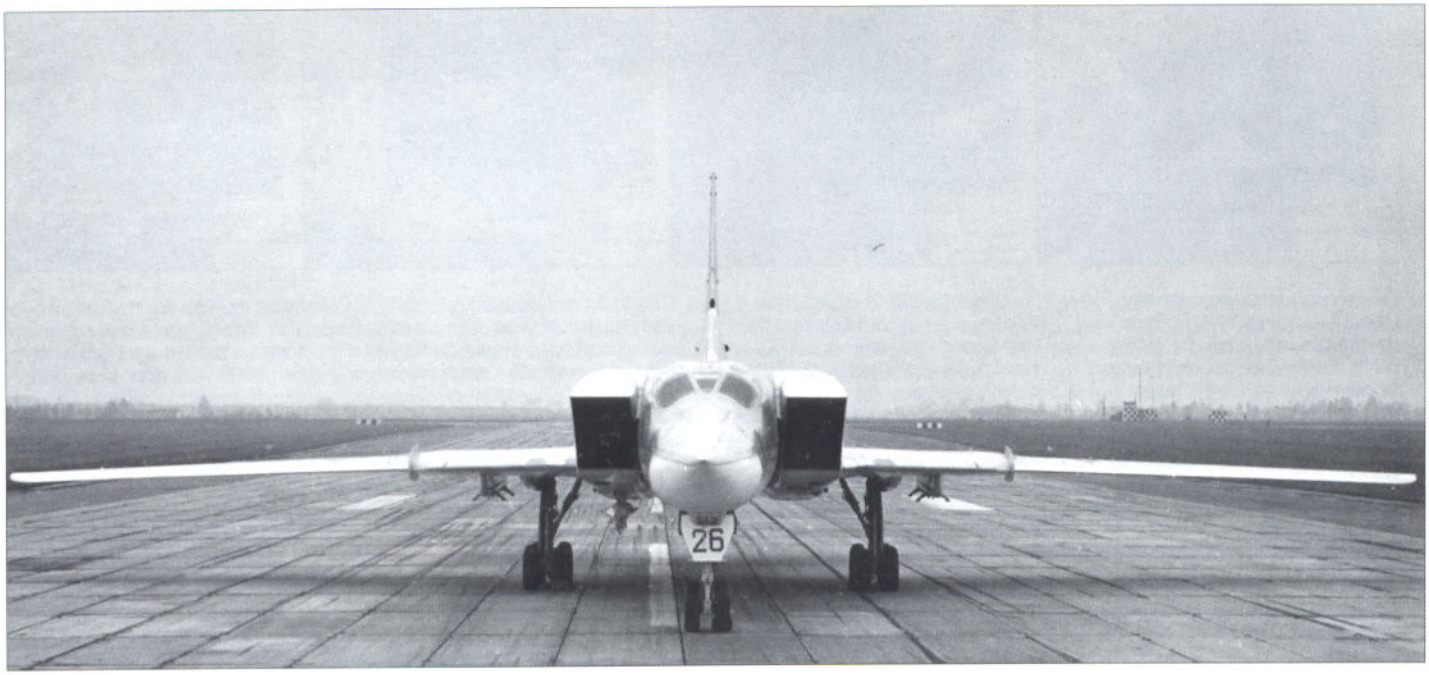
Below: **Tu-22M3.** Yefim Gordon archive



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Front cover illustration:

Tu-22M2 'Red 07' at Shaikovka.
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Back cover illustrations:

Top: **Navy Aviation Tu-22M3 'Red 44' at Ostrov.**
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Above: **Line-up of Tu-22KDs.**
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